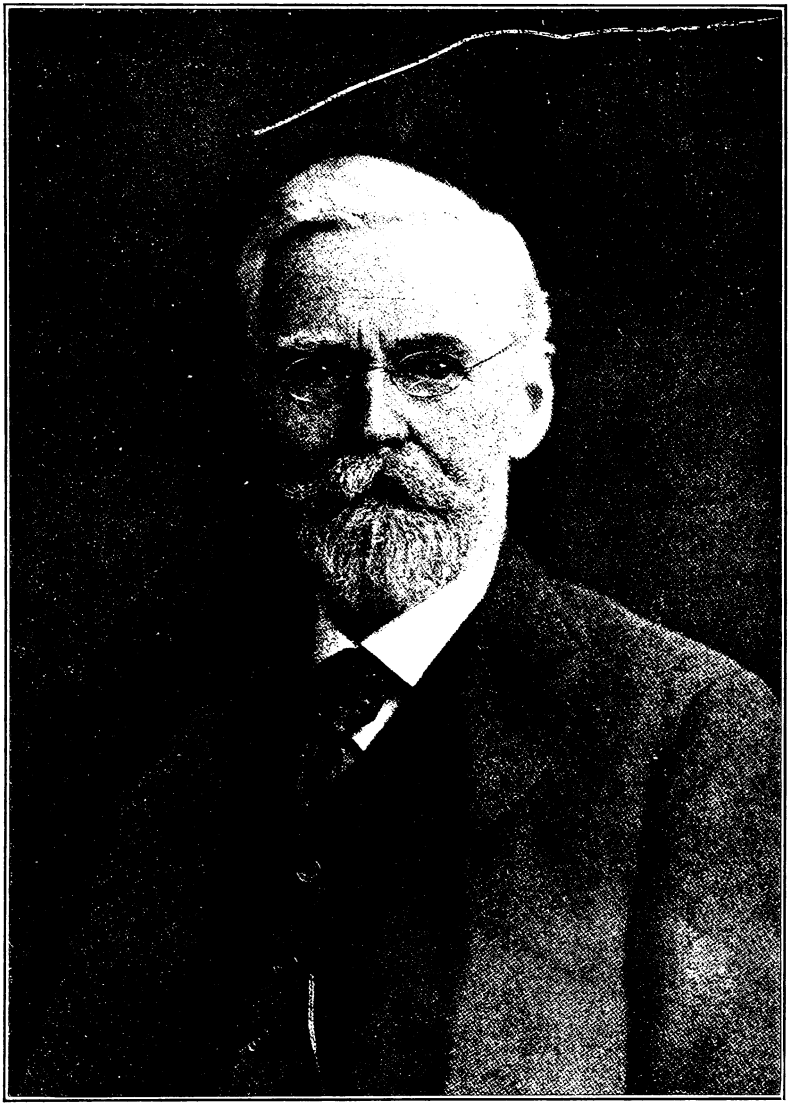


Dr. C. Newlan Peirce.


# The Influence of the Premaxillæ upon the Form of the Hard Palate and upon the Septum.

By Harris Peyton Mosher, M.D., Boston.

*Read before the American Society of Orthodontists at Washington, November,* 1908.

The premaxillæ are so inconspicuous in the human palate that their existence is liable to be forgotten or their importance underestimated. This is natural because they are small bones and they become anchylosed with the superior maxillæ early, and in great part covered by them. When, however, the premaxillæ are studied in animals, they are found to be a prominent part of the muzzle. Not only are they much larger than they are in man, but the special teeth which they bear, the incisors, undergo striking variations. It is well, therefore, to come to the study of the premaxillæ in the human subject, remembering their increased importance in animals, and their great variations.

The subject of this paper is: "The Influence of the Premaxillæ upon the Form of the Hard Palate and upon the Septum." The first division of the subject can be dealt with rather shortly; the second division occupies the greater part of the paper and requires the consideration of many details. The first part of the subject has as yet a limited practical bearing; the second has a practical bearing which is immediate and most important.

The skeleton of the paper is as follows:

1. The comparative anatomy of the premaxillæ.

2. The influence which non-shrinkage and failure of readjustment of the premaxillæ exert upon the form of the hard palate.

This concludes the first part of the paper. The second and the longer part of the paper deals with the influence of the premaxillæ upon the septum. This second part of the subject is considered under the following subheadings:

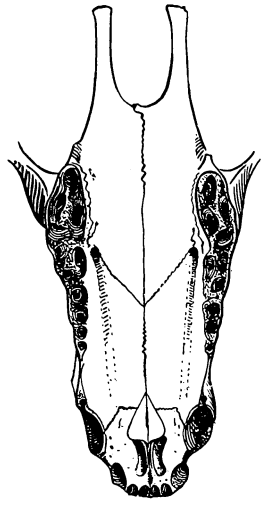


FIG. 1.

The palate of a bear.

1. The description of the premaxillæ.
2. The changes in the premaxillæ as the incisor teeth erupt.
3. The effect of delayed and irregular eruption of the incisor teeth upon the septum.
4. A description of clinical cases of delayed or irregular eruption of the incisor teeth and the nasal findings in these cases.
5. A description of the anatomical findings in specimens of deviated septa found post mortem.
6. A summary of the clinical and anatomical findings.
7. The prophylaxis of deviations of the septum.

An animal gets its living with its arms and teeth; man obtains his living with his arms and brain. In the skull of man the brain cavity dominates; in the animal the jaws and snout. The two chief changes which take place in the development of the skull of man from the skulls of his animal ancestors are the enlargement of the brain case and the

shrinkage of the jaws. From the mechanical standpoint the first change is much easier to bring about than the second. In this shrinkage of the jaws in man the teeth lose two of their striking animal characteristics. All other primates except man have a gap or diastema between the incisor teeth and the canines. This gap is filled up in man so that the teeth present a continuous series. In most animals, but especially in the carnivora, the crowns of the teeth are not on the same level. In man, however, the teeth not only form a continuous series, but when they are fully erupted their crowns are of equal height. The number and the arrangement of the teeth in man show that he is not intended to be a ferocious, biting animal, but a contemplative, chewing animal. Some years ago, as you remember, Gladstone made a point of this, and recently it has been emphasized again by Fletcher in his attempt to revise our habits of eating.

In order to realize what must be accomplished in bringing about the reduction of the size of the jaws, the obliteration of the snout and the readjustment of the different parts of the hard palate, look for a moment at the palate of a bear (Fig. 1). In the bear the largest part of the hard palate is made by the palatal processes of the palate bones. The processes of like name of the superior maxillæ make the next largest part, and the premaxillæ the smallest part. In the ascent to man the parts of the palate which have changed the most are the palatal processes of the palate bones and the premaxillæ. The middle of the palate has changed but little.

## The Parts of the Palate.

The palate of man, like the palate of most animals, consists of three parts: a large central part made by the meeting and fusion of the horizontal processes of the superior maxillæ; a small posterior part made in the same manner by the palatal processes of the palate bones; and a small anterior part made by the two premaxillæ which lie on either side of the middle line, and fit into the palate like a wedge. The premaxillæ are distinguished by the fact that they bear the incisor teeth. Each premaxilla carries one central and one lateral incisor.

In man the premaxillæ do not show such gross variations as they do in animals. In animals not only do they vary much in size and shape, but the teeth which they support are subject to striking variations. For instance, in animals which gnaw the central incisors are enormously overdeveloped. The tusks of the elephant are simply large central incisors. In the narwhal, an animal of the sword-fish type, there are never

but two teeth, and these are central incisors. In the male one of these aborts while the other grows out into a large tusk. In the bear the premixillæ are heavy and thick, in the sheep they are light and thin. Bearing in mind the variations which are found in the premaxillæ of animals one should not be surprised to find variations in these bones in man,

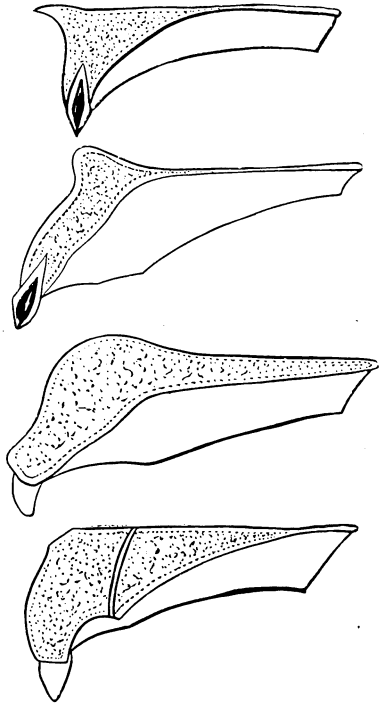


FIG. 2.

The upper figure represents a palate in which there has been normal shrinkage and readjustment of the premaxillæ. The other figures are from cases in which these changes have been faulty.

especially as in man both the teeth and the hard palate are subject to greater individual variations than in any other animal.

## Comparative Anatomy of the Premaxilla.

According to Owen, a premaxilla is almost a constant element in an osseous skull, yet in some bats and shrews it aborts. In birds, on the

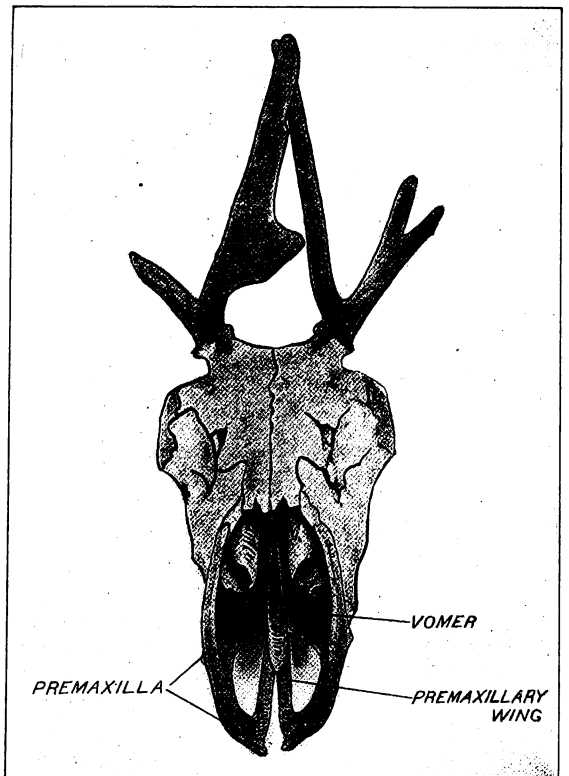

VOMER
PREMAXILLA
PREMAXILLARY WING

FIG. 3.

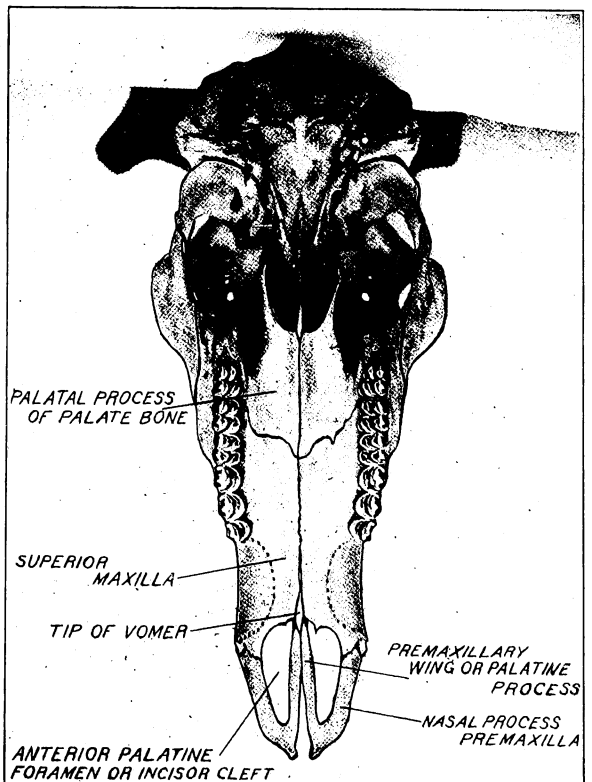

PALATAL PROCESS OF PALATE BONE
SUPERIOR MAXILLA
TIP OF VOMER
PREMAXILLARY WING OR PALATINE PROCESS
NASAL PROCESS PREMAXILLA
ANTERIOR PALATINE FORAMEN OR INCISOR CLEFT

FIG. 4.

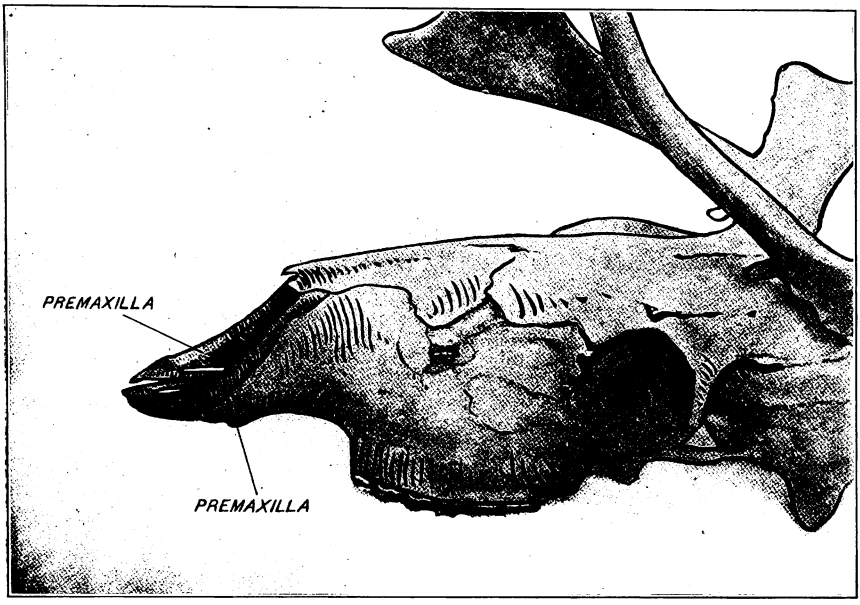



FIG. 5.

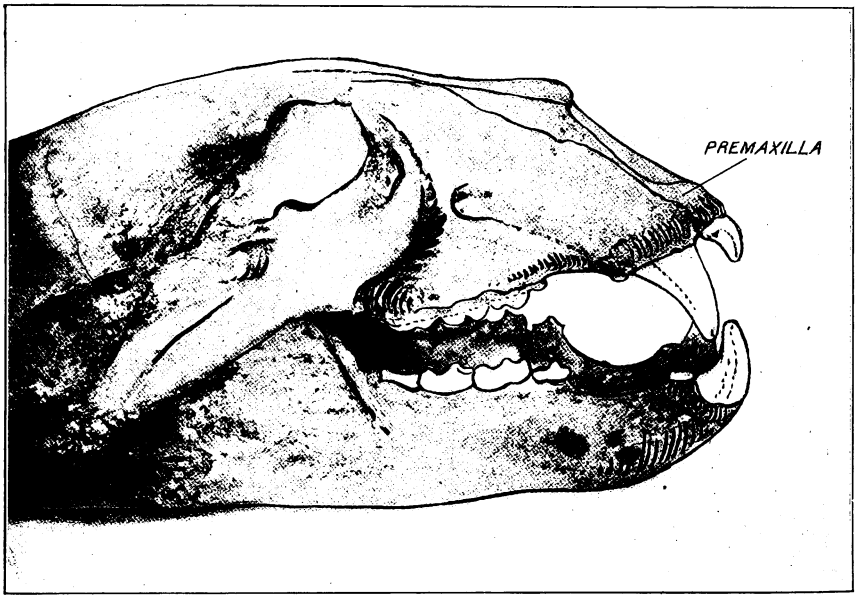



FIG. 6.

contrary, it becomes very large, forming the greater part of the upper half of the beak. It is generally double in batrachians, and apparently always so in fishes. In serpents, however, the premaxilla consists of a single median bone.

In man's class the premaxilla varies greatly in size. This may take

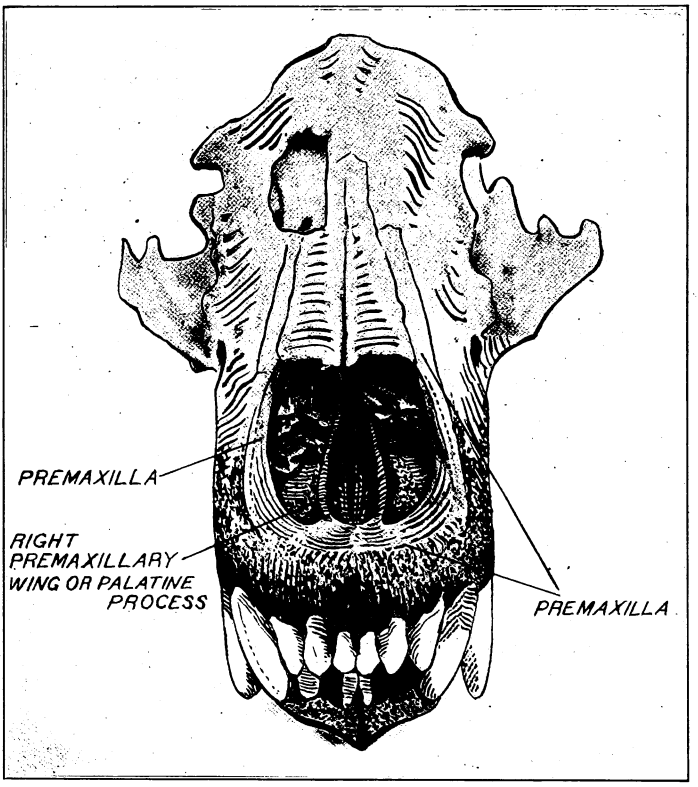



FIG. 7.

place independently of the development of the muzzle and of the teeth, For instance, the ant-eater and certain whales are both toothless, and both have an enormously extended muzzle, yet in the first the premaxilla is small; whereas, in the second, the whale, it is excessively large. The thickness of the premaxilla, however, depends almost always upon the development of the teeth. A nasal spine, one of the processes of the premaxilla, exists in the walrus, but it is so rare, except in man, as to be practically a human characteristic.

Generally the development of the premaxilla is related to the development of incisor teeth which are defined by the fact that they are implanted in it, although when they are large, as in rodents, their roots may extend backward into the superior maxillæ.

In certain bats the premaxilla is separated from its fellow of the opposite side. In some animals the premaxillæ may be united not only below, but also above, the anterior nares. Again, they may be united in the median line, but separated entirely from the superior maxillæ.

Two striking examples of the variations of the premaxillæ in animals are furnished by the skull of the bear and the skull of an elk. In the bear the premaxilla is very thick for the support of the heavy incisor teeth. In the elk, where there are no upper incisor teeth, the premaxillæ are hardly more than skeleton bones when compared with the premaxillæ of the bear. In both the groove made by the two leaves of the vomer, and by the two premaxillary wings are very marked. In the bear the premaxillary wings are very strong, in the sheep they are very slender. It is noticeable, however, that in the rudimentary premaxillæ of the sheep the premaxillary wing is a true process of the premaxilla. The premaxillary wing in man has usually been held to be a separate ossification. Dissection has led me to consider it a process of the premaxilla the same as it is found to be in the elk (Figs. 3, 4, 5, 6, 7).

## The Influence of the Premaxillæ upon the Form of the Palate.

The palatal arch, with projecting premaxillæ, is characteristic of the negro race. It is an animal peculiarity and gives a very distinctive form to the face. The proper shrinkage and readjustment of the premaxillæ play a very important part in the formation of the palate. Other factors, such as the malocclusion of the teeth, the low descent of the antra, and asymmetry between the halves of the palate, also are important factors in determining the form of the palate. These factors I have considered in a paper which is shortly to be published. In man the premaxillæ must undergo two changes in order to make the normal palate. They must shrink in size and must turn downward so that the incisors may become nearly vertical. Both changes must be accomplished in the proper degree. Often, however, the premaxillæ fail to accomplish one or both of these changes. When both fail to occur the result is the negro type of palate. In the negro the premaxillæ are large and thick, and shoot markedly forward. In other respects the arch is very symmetrical. In certain other cases the premaxillæ undergo but one of the two changes necessary for the production of the normally formed palate. In such instances they

change their position as they should, and bring the incisor teeth to a vertical line so that there is only the normal overhang; they do not, however, shrink in size. It is a peculiarity of the human dentition that when the teeth are fully erupted they all reach down to the same level. The anterior teeth reach their proper level first, the molars last. That is, the incisor teeth set the level which the other teeth must attain. If, now, owing to the lack of proper shrinkage, the premaxillæ are longer than they ought to be, the palatal arch will be deep anteriorly, and when growth is completed and the rest of the teeth have attained the level set for them by the incisors the arch will be deep posteriorly. Non-shrinkage of the premaxillæ, therefore, is one cause of the high arch. A high arch due to this cause is not usually pointed, but has a narrow symmetrically curved dome.

In the negro the non-shrinkage and the failure of readjustment in the premaxillæ are racial characteristics. In the white, premaxillæ of the negro type are due, I think, to faulty eruption of the incisor teeth, and, perhaps, in part to trauma. The premaxillæ are the most exposed parts of the jaw. The books say they do not fuse until well into the first year. I suspect that they are not firmly united to the superior maxillæ until the third or fourth year. As will appear in the discussion of the second part of the paper the premaxillæ at the start are mere shells of bone, and do not acquire any considerable solidity until the second incisors are well on their way to full eruption.

In addition, as you know, the crowns of the second incisors fill the body of the premaxillæ to bursting, and are so slightly covered that they are readily accessible to trauma applied within the anterior part of the mouth. The palatal surfaces of the premaxillæ are further weakened by large openings for the gubernaculæ. Beside the mild form of trauma represented by thumb-sucking there are the innumerable bumps of early childhood upon the nose and upon the anterior teeth to injure the sacs of the second incisors, and so interfere with the proper growth of the premaxillæ.

## The Premaxillæ in Man.

The existence of the premaxillæ in man is obscured even at birth, except on the surface of the palate by anchylosis, and masked by the extension over them of a delicate plate of the maxillary bone. This plate, which hides the premaxillæ, is wanting in all other animals. In apes the maxillo-premaxillary suture is for a long time or permanently evident on the face.

The two premaxillary bones form the sockets for the upper incisor

teeth. In the human fetus at birth the suture between the maxilla and the premaxilla can be seen on the hard palate (Fig. 8). It runs diagonally forward and outward from the anterior palatine fossa to the alveolus between the lateral incisor and the canine tooth. On the facial aspect the

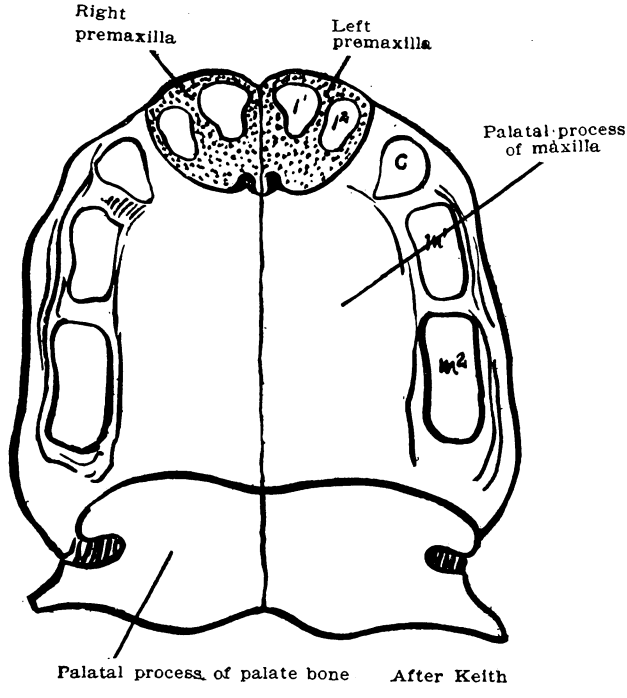



FIG. 8.

The hard palate at birth. The premaxillary part is formed from the mesial nasal processes. The remainder by the palatal processes of the superior maxillæ and of the palate bones.

premaxillæ fuse with the superior maxillæ in the third month of fetal life, the maxillæ overlapping and almost completely excluding them from the face.

In man each premaxilla is usually ossified from two centers placed side by side. The two premaxillæ unite in the first year after birth. Their vestigal character in man is due to the small size of his masticatory apparatus and the consequent retrogression in the development of the facial part of his skull. (Keith, pp. 3-5.)

Each premaxilla is an oval shell of bone, all the faces of which are very thin. The body of the bone is completely filled with the crowns of the incisor teeth and accurately takes its form from them (Fig. 9). Projecting horizontally forward from the anterior edge of the upper

Fig. 1. Side view.

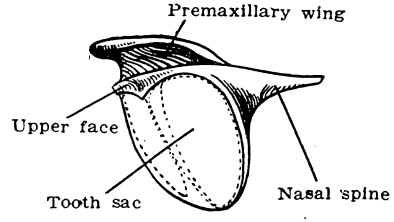



Fig. 2. View from behind.

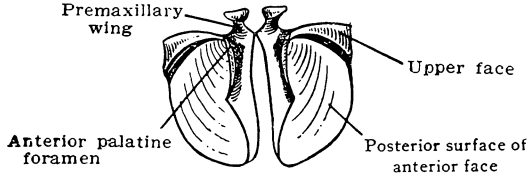



Fig 3. Premaxilla seen from above.

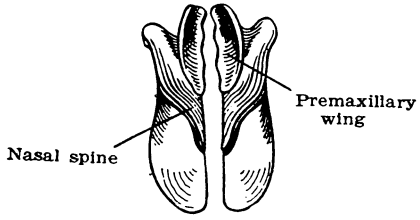



FIG. 9.

The premaxilla at birth.

face of the premaxilla is a pointed process called the nasal spine. The superior surface of this is slightly concave. Also projecting from the upper face of the premaxilla in the middle line, but projecting obliquely upward and outward, is another process, the premaxillary wing. This process extends along the posterior two-thirds of the superior face of the premaxilla. Its upper surface is markedly concave. The inner edge of the base of this process is irregularly undermined so that it can mortice into the corresponding process of the other premaxilla. The upper edge of the wing slopes outward and the root of the wing on its outer side is

constricted by a smooth gutter, as if for the passage of a vessel or a nerve. Owing to this the wing has a narrow constricted base and a concave flaring surperior surface. When the two premaxillary wings are placed together their bases fit into one another so that the wings form a sizable gutter. Into this, in the complete septum, fits the tip of the vomer, also a gutter. The premaxillary wings act as cleats on either side of the tip of the vomer to hold it in place. Their position controls the position of the vomer.

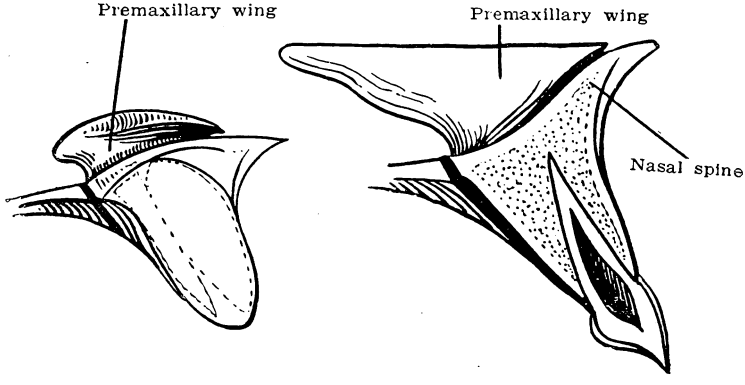



FIG. 10.

Fig. 1. Premaxilla at birth. Fig 2. The premaxilla in the adult.

From birth up to six years of age the premaxillary wings increase in size but little. From this time on, however, they enlarge rapidly, so that in the adult each wing measures about half an inch along its upper border, and is a quarter of an inch in height (Fig. 10). The premaxillary wing grows especially upward and backward, so that its final form is triangular. The apex of the triangular piece of bone which constitutes the premaxillary wing points downward and rests just in front of the anterior palatine fossa. This process undergoes a greater proportional growth than almost any other part of the septum. This is necessary in order that the premaxillary wings should not lose control of the vomer.

The premaxillary wings are said to fuse with the tip of the vomer at fifteen years of age. On account of their position and on account of this fusion with the vomer, the two processes have usually been known as the sub-vomer bones. Dissection has led me to consider them not as

separate bones, but as processes of the premaxillæ the same as the nasal spines. At birth the premaxillary wing is firmly united to the superior face of the premaxilla by a slender neck and apparently is a part of it. For this reason I call this process the premaxillary wing.

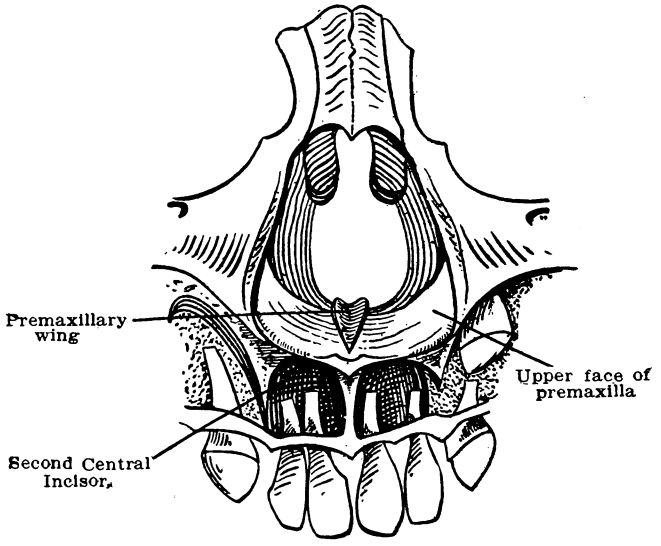



Fig. 1.

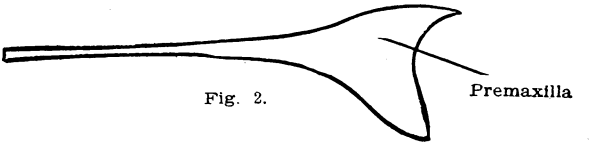



Fig. 2.

FIG. 11.

Fig. 1. Dissected alveolus of a child three years old. The upper face of the premaxilla is flat and fits accurately over the top of the second incisor.

Fig. 2. Shows that the upper face of the premaxilla is almost flat.

## The Changes in the Premaxillæ as the Incisor Teeth Erupt.

As the antra enlarge and descend with the eruption of the second teeth the crest of the palate bone and the crest of the superior maxilla grow upward (Fig. 13). At the same time the nasal spines and the premaxillary wings also grow in the same direction. Heretofore the superior face of the premaxilla has been flat like a plateau. This plateau now disappears and the superior face slopes downward and backward at an

angle of forty-five degrees. For this the upward growth of the nasal spine is in great measure responsible. The nasal spine in the adult makes a bony rim about the vestibule and turns the incisor plateau of infancy into a moat.

The fact that the inclination of the superior face of the premaxilla depends upon the teeth below it and changes as these erupt is shown prettily by dissections. At birth the upper rim of the hollow crown of the middle incisor fits snugly under the thin upper face of the premaxilla. The upper rim of the crown is flat, and so also is the superior face of the pre-

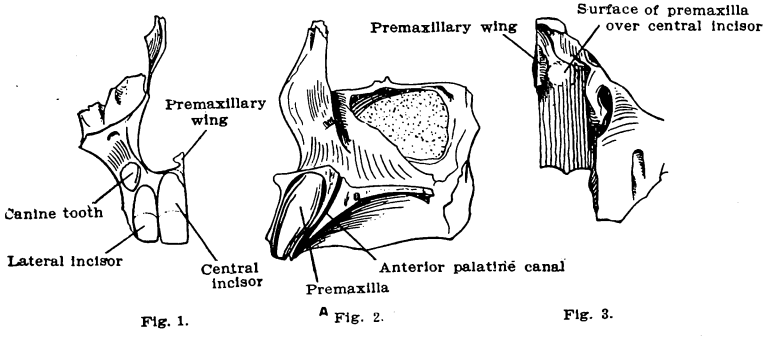



FIG. 12.

The premaxilla and the superior maxilla from a child of six.

maxilla which is paper-like in thickness and roofs it over. This is shown in Fig. 11, which is drawn from the dissected alveolus of a three-year-old child. As the flat rim of the upper part of the hollow crown gives place to the pointed root, the superior face of the premaxilla changes from a plateau to a slanting surface. The form of the nasal notch changes in the meantime from a triangular aperture to a heart-shaped opening. Normally, therefore, the line of the superior face of the premaxilla and the shape of the nasal notch are determined by the degree of eruption of the incisor teeth. Fig. 12 represents the superior maxilla and the corresponding premaxilla at six years. In this specimen the upper rim of the crown of the central incisor is flush with the under surface of the superior face of the premaxilla, and occupies the greater part of it. The layer of bone over the tooth crown is still paper-thin, whereas the amount of bone over the lateral incisor is much greater. The lateral incisor could have but little influence compared with the central incisor upon the form of the superior face of the premaxilla and upon the premaxillary wing (Fig. 12). All parts of the alveolus except that part

made by the premaxillæ are buttressed by the walls of the antrum (Fig. 13). The superior face of the premaxilla is free in the nose and not so buttressed. The form of this, therefore, can be readily altered.

If the normal eruption of the incisor teeth causes a change in the upper face of the premaxilla the question is at once suggested: Does delayed or irregular eruption of the incisor teeth cause a still further change, a change which is of any significance in the pathology of the septum? It does.

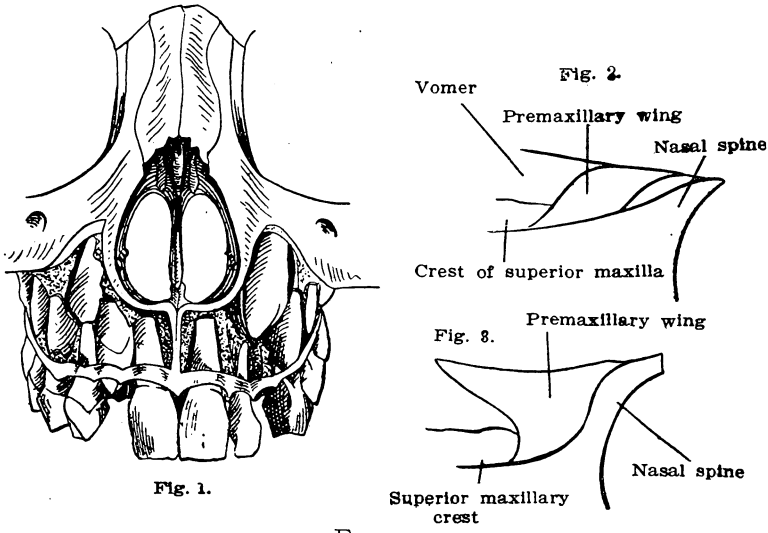



FIG. 13.

Fig. 1. Dissected alveolus of a child eight years old. The nasal notch has lost its former triangular shape.

Fig. 2. The upper face of the premaxilla. The nasal spine and the premaxillary wing are beginning to grow upward.

Fig. 3. The nasal spine and the premaxilla have their adult growth.

In order to understand how this may take place it is necessary to review the anatomy of the septum.

**The Septum at Birth.**

The septum at birth is almost all cartilage (Fig. 15). The only bony parts are the vomer and the two premaxillæ and their processes. The vomer has a very characteristic form. It consists of two leaves of thin bone, which are united below, but are open and flaring above (Fig. 16). This formation is a relic of its double origin, evidences of which the vomer never entirely loses. The premaxillary wings make the vomer over again in miniature. That is, they also form a V, or gutter.

The premaxillary wings spring from the posterior half of the upper face of the premaxillæ. In the groove which they form rests the tip of the vomer. Two other processses spring from the superior surface of the premaxillæ, one from each, namely the nasal spines. These again make a slight gutter, into which in its turn fits the tip of the premaxillary wings. The tip of the vomer rests in the gutter of the premaxillary wings, and

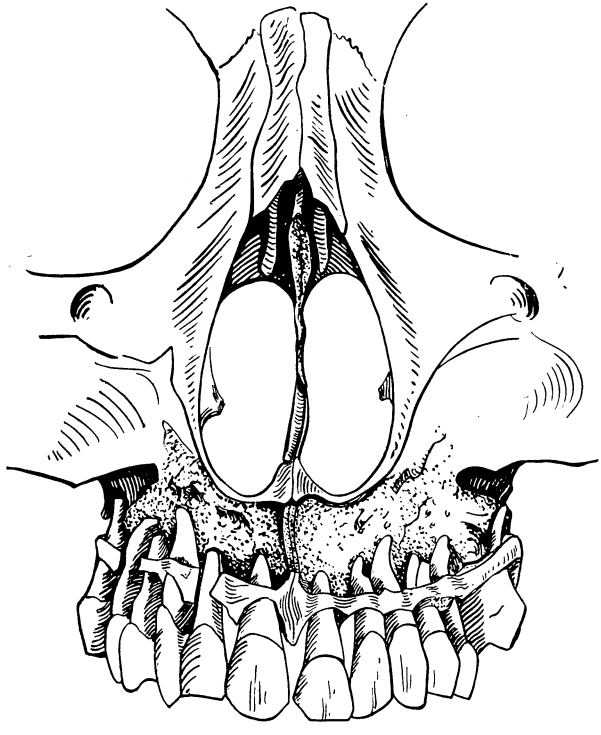


FIG. 14.

Dissected alveolus of an adult. The nasal notches have the adult heart-shaped form. (See Figs. 13, 3.)

the tip of the premaxillary wings rests in the gutter of nasal spines, like the arrangement of the sections of the old-fashioned V-shaped wooden drain (Fig. 17).

**The Adult Septum.**

The upper border of the adult vomer is gutter-shaped like the vomer at birth, the gutter not being so deep (Fig. 18). It is surprising how long the vomer retains this characteristic to a very marked

degree. At four years of age the vomer still consists of two leaves for half its height. In the adult septum the lower border of the perpendicular plate of the ethmoid is gutter-shaped the same as the upper border of the vomer, with which it articulates. Between these two bones, therefore, there is a lozenge-like space filled with cartilage. The strip of cartilage which fills this space is an offshoot from the posterior inferior angle of the quadrangular cartilage. It runs backward and upward in the space left for it, at times reaching the front wall of the sphenoid. This is called the caudal prolongation. There are other peculiarities of the adult septum

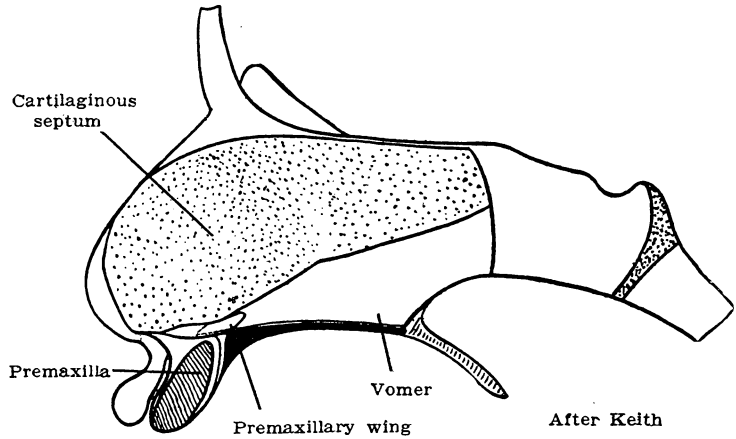



FIG. 15.

The septum at birth.

which have a bearing upon the subject of this paper. They may be grouped as follows: The lower part of the quadrangular cartilage just above the premaxillary wings is very thin, whereas the upper part in line with the middle turbinate is thickened into what is called the tubercle. After eight years of age the growth of the quadrangular cartilage occurs chiefly at a center of growth just above the premaxillary wings. There is a second less important center half way up its posterior border. At birth neither the palate bones nor the superior maxillæ rise into a crest for the support of the lower edge of the septum (see Fig. 15). In the adult, on the other hand, both of these bones have marked crests. These grow upward while the rest of the septum is growing downward, affording at times a factor in disturbing the equilibrium of the mosaic of the septum. This factor is not generally considered.

It has usually been held that the weakest part of the septum is the articulation between the upper border of the vomer and the lower edge of the perpendicular plate of the ethmoid. From the description of the septum which has just been given it is easy to see why this is so. There is, however, another part of the septum which is even weaker. This place is at the tip of the vomer, or the region of the premaxillary wings. Here the mosaic of the septum is the smallest, here the tip of the vomer lies in the groove of the premaxillary wings, here the caudal prolongation

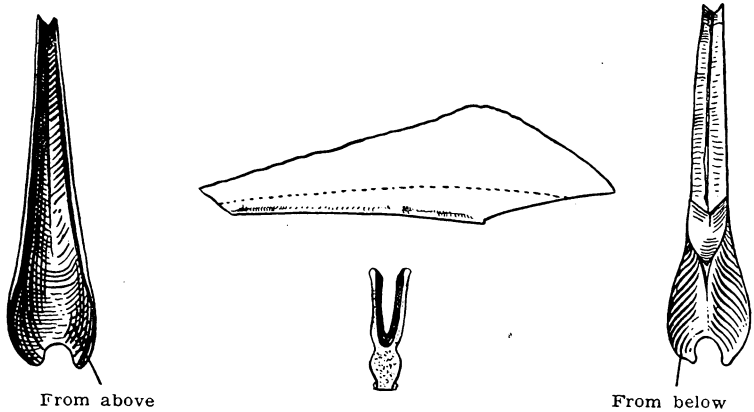



FIG. 16.

The vomer at birth, showing the two leaves and the gutter made by them.

of the quadrangular cartilage starts, here the quadrangular cartilage is the thinnest, here is placed the remnant of the organ of Jacobson, and here the quadrangular cartilage has its chief center of growth. Anatomically, therefore, this part of the septum is especially fitted to be the starting point of spurs and deviations. If for any reason the equilibrium of the septum is upset one would expect it to show itself first at this point.

## The Condition of the Septum in Forty Cases of Delayed Dentition.

If the normal eruption of the incisor teeth causes a change in the upper face of the premaxilla the question is at once suggested: Does delayed or irregular eruption of the incisor teeth cause a still further change, a change which is of any significance in the pathalogy of the septum? It does. I asked and answered this question some pages back. The reasons for my answer I will now give. Within the last

month I have collected forty cases of irregular and delayed eruption of the incisor teeth.* The patients were mostly children who came to the clinic to have their tonsils and adenoids removed. The ages of the majority were between seven years and twelve. Five of the cases were adults. Through the kindness of Dr. L. B. LeGro, of Haverhill, I had the opportunity to examine four cases from his private practice where the history of the teeth was known from the beginning, and where the teeth

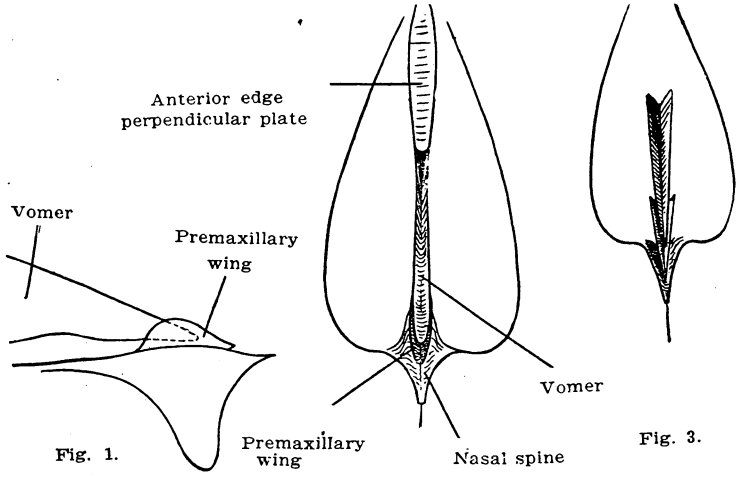



FIG. 17.

Fig. 3 is a diagrammatic drawing showing how the vomer lies in the gutter made by the premaxillary wings, and the premaxillary wings lie in the gutter made by the nasal spines.

had been carefully watched and cared for. Since every point in connection with these cases could be followed I will give the cases in detail.

**T. B., Female, 8 Years.**

The eruption of the incisors occurred six months ahead of time. The right middle incisor is fully down and in good line. The left middle incisor is just appearing through the gum. Both first lateral incisors have been lost and neither second lateral incisor is showing.

**Nasal Examination.**

The wing of the premaxilla on the side of the left central incisor, the delayed incisor, is enlarged. There is a left vomer spur running back from this for one-half inch. The right premaxillary wing is

*This was written about two years ago, since that time I have seen in all over a hundred cases.

not enlarged. The septum deviates moderately to the right, for three-quarters of an inch backward.

The arch of the palate is moderately high. Both halves of the arch are of equal height. There is no nasal obstruction. The tonsils and the

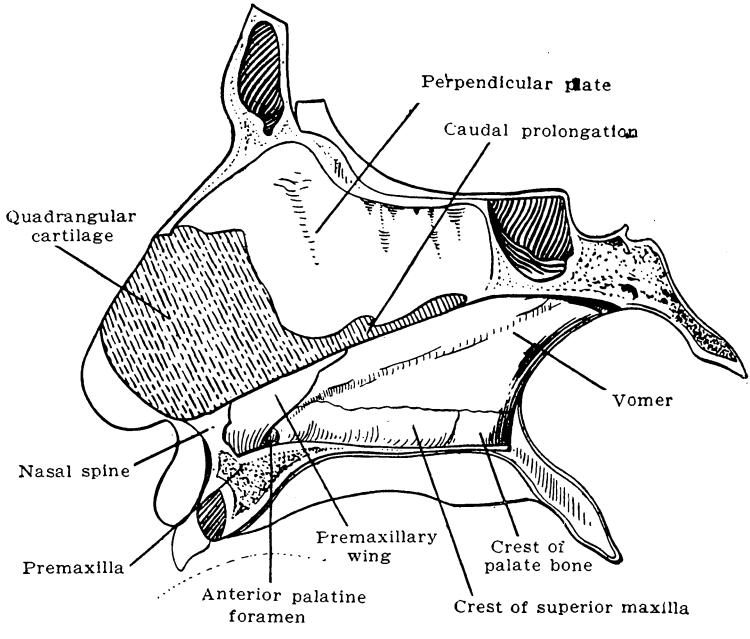



FIG. 18.

The adult septum.

adenoids were removed three years ago. There are practically no tonsils.

**G., Male, 8½ Years.**

Both central incisors are fully erupted and in perfect line, at the present time, but the patient's history card states that the left middle incisor came down six months after the right middle incisor, and six months after the normal time of eruption. The arch of the palate is normal, and both halves are of equal height.

**Nasal Examination.**

There is a slight vomer spur on the left, and a slight deviation of the septum to the right, beginning about a third of the way up on the septum and running one-half inch backward. There is a slight vome-

spur on the right. There is no nasal obstruction. The tonsils and the adenoids were removed three years ago. There are practically no tonsils to be seen.

**M., Female, 18 Years.**

The left incisors and the left canine were delayed in eruption, and were irregular and crowded. Much regulating has been done to the teeth, and the first bicuspid has been removed in order to allow the teeth in front to come into line.

**Nasal Examination.**

The premaxillary wing on the left is slightly enlarged with a slight deviation of the septum into the right side. The axis of the deviation is horizontal. There is moderate enlargement of the wing of the premaxilla on the right running backward one-half inch. Half way back on the vomer-ethmoid junction there is a small sharp spur. The arch of the palate is normal, and both halves are of equal height. There is slight chronic rhinitis, and a moderate granular pharyngitis.

**M., Male, 9 Years.**

All the upper incisors of the first dentition are still in place. Normally these should have fallen out two years ago. The incisor teeth are regular in outline, but are movable on pressure as if they were on the point of being cast off. The nasal bones are in good line. There is no history of trauma, and there is no nasal obstruction. The arch of the palate is normal and both halves are of equal height.

**Nasal Examination.**

There is a large vomer spur on the left, running well back. The left premaxillary wing is much enlarged, the right premaxillary wing slightly enlarged. The septum deviates into the right nostril. The axis of the deviation is horizontal.

These four cases are from families in good circumstances, so that the teeth have had every care. In all, the line of the nasal bones was straight. In all, strict questioning of the parents brought out no history of trauma. In the first three cases there was moderate delay and irregularity in the eruption of the incisor teeth. In these examination showed an enlargement of the premaxillary wing on the side of the delayed tooth and a slight deviation of the anterior part of the septum. In the fourth case the first incisor teeth were retained two years beyond the time when they should be shed normally. In this case there was a very large premaxillary wing on one side with a large vomer spur running well backward from it, a moderate enlargement of the other, and in addition there was a deviation of the septum into the opposite side. So marked was the deviation that any increase from continued growth along

the present vicious lines or any sudden increase from trauma must produce obstruction.

The case of the girl of eighteen is of especial interest, because she started with delayed and crowded teeth. Her teeth were carefully regulated, however, and brought into line so that her septum escaped with but slight deformity. The lesson of such a case is obvious. At the time that I saw the second of these four cases both central incisors were equally

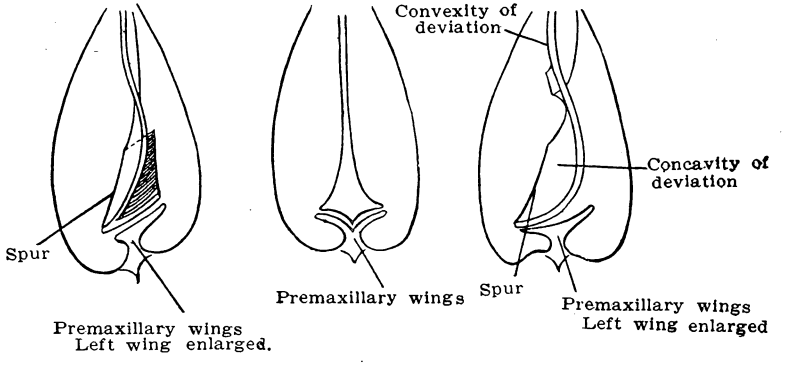



FIG. 19.

Diagrammatic drawings of the types of deviation due to deformity of the premaxillary wings.

Fig. 2. Both premaxillary wings turned outward, causing a double basal spur of the septum.

and fully erupted and in good line, but the history card showed that the left middle incisor came down six months after the right middle incisor and six months delayed. In the nose, on the side of the lagging incisor, examination showed that the premaxillary wing was enlarged and that there was a small vomer spur on the same side. The septum deviated slightly to the right. From these cases it is seen that the history of the eruption of the incisor teeth is to be read in the nose.

The results of the findings in the rest of the forty cases can be put very briefly. They are as follows: Wherever there was moderate and equal delay in the eruption of the central incisors the premaxillary wings were symmetrically enlarged at the floor of the nose on both sides. In such cases there was usually little if any deviation of the septum, and there was no vomer spur. Where, however, there was marked inequality and delay in the eruption of one central incisor as compared with the other,

on the side of the backward tooth the premaxillary wing was much enlarged or displaced, and the quadrangular cartilage tipped out of its bed along the vomer ethmoid suture. As a rule the long axis of the deviation was antero-posterior, roughly paralleling the spur, and the upper part of the cartilage was bowed toward the spur. Accompanying this horiontzal deviation there was often a certain amount of sigmoid

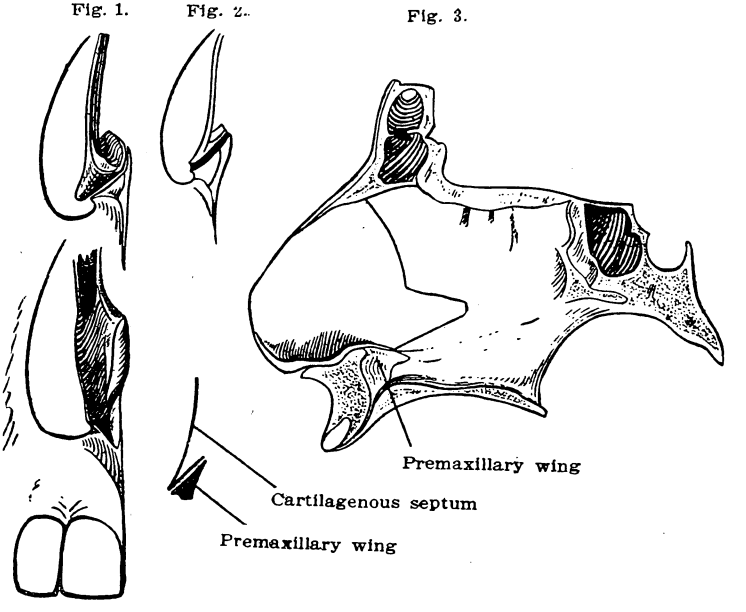



FIG. 20.

Specimen of a deviation of the septum due to an enlarged left premaxillary wing.

Fig. 1. Dissection of the groove of the premaxillary wings. Left wing enlarged.

Fig. 2. Scheme of the deviation.

deviation, the axis of which was vertical. It is fairly common to find the root of the lateral incisor rising like a mound into the outer part of the floor of the nose. Even when the lateral incisors are crowded out of the dental curve and are placed directly behind the central incisors, a deformity which is striking and one from which you naturally expect much at first glance, they seem to have but little influence on the septum, compared with the central incisors.

## The Anatomical Finding in Dissected Specimens.

The findings of these forty clinical cases are borne out and the details of their formation explained, by the dissection of twelve cases in which an enlarged or displaced premaxillary wing caused a deviation of the septum. These dissecting-room specimens show that if the pressure caused by the premaxillary wing is applied to the septum directly in its

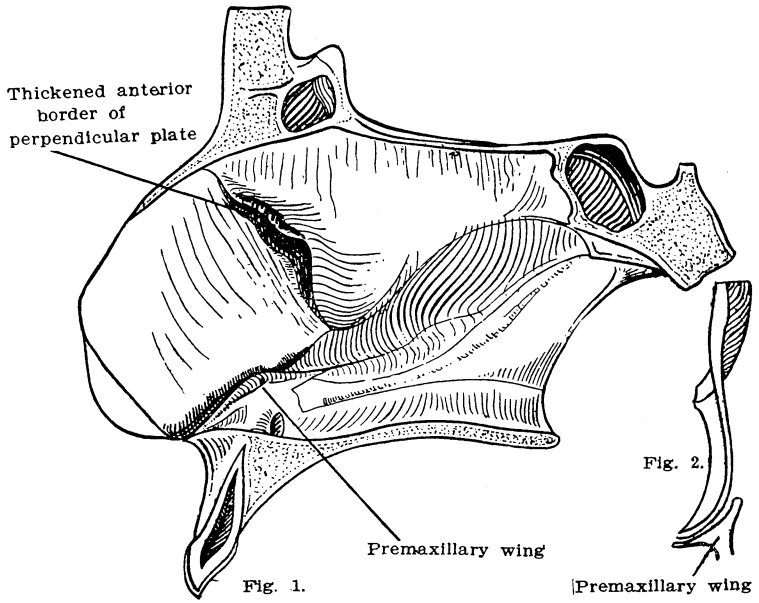



FIG. 21.

Fig. 1. Deviation due to enlargement of the premaxillary wing.
Fig. 2. Dissection of the deviation.

vertical axis, the lower edge of the cartilage stays in its bed, whereas the lower part folds sharply upon itself, the axis of the fold paralleling the upper border of the vomer (Fig. 19). More often, however, the force seems to be applied a little to one side of the vertical axis of the septum. When this happens, the lower rim of the cartilage is forced out of the groove between the retaining premaxillary wings and also out of the groove between the two leaves of the vomer, and curls upward and outward. As it does this it breaks off one premaxillary wing or stunts its growth and does the same thing to the corresponuding leaf of the vomer. This results in the formation of the familiar spur along the vomer

ethmoid articulation (Fig. 20). The concavity of the lower portion of the cartilage about half way up the septum merges into a compensatory convexity. These dissected specimens bear out the clinical findings that the convexity generally is toward the spur and away from the enlarged premaxillary wing (Fig. 21). Occasionally, however, the reverse of this is found. The spur, as a rule, is on the side of the con-

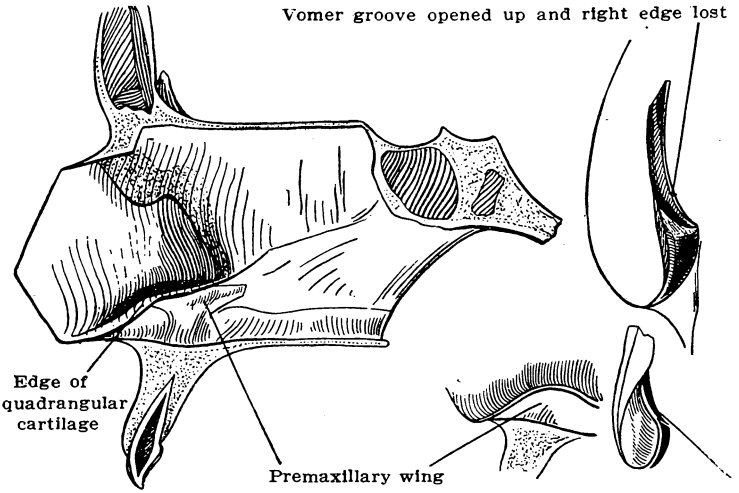



FIG. 22.

Deviation of the septum due to the enlargement of the premaxillary wing. Small figures, the dissected anatomy of the deviation.

vexity and seems to crown it. The enlarged premaxillary wing is found in the dissected specimens to make an anterior basal spur which runs from a quarter of an inch to an inch backward. Further, the dissected specimens show that when the two premaxillary wings are enlarged but slightly, and are enlarged equally, they often tip outward and make a small anterior basal spur on either side of the septum. Where, however, both premaxillary wings are evenly enlarged to a considerable extent, and the pressure caused by this enlargement is not equalized by their turning outward, as in the case just described, the tip of the septum is first pushed upward and then to one side (Fig. 22). The septum in this case yields instead of the premaxillary wings. I found this condition in the skull of a three-year-old child.

It should be borne in mind, however, that the nasal spine is the cause of deviations in certain cases. In the cleaned skull the nasal notch on the side of the enlarged premaxillary wing is higher than the notch of the other side. The X-ray will demonstrate this in the living.

I feel that good anatomical and clinical evidence has been given to show that enlargement of the premaxillary wings, the enlargement being due to delayed eruption of the incisor teeth, must be considered as an important cause of deviations of the septum.

## Treatment.

That there is a relationship between the teeth and the nose has been known for many years. Zuckerkandl at least fifteen years ago, and Potiquet ten years ago, drew attention to the fact that irregularity in the eruption of the incisor teeth could deform the septum. Since Potiquet the observation has lain dormant. I found his observation quoted in the "Anatomy of the Nasal Fossæ" of Sieur and Jacob, and tried to substantiate it for myself. I have just given you the result of my work. For me it is settled that the incisor teeth can deform the septum. The great practical question at once arises: "What can be done in order to prevent this?" The answer is found in the following fact: Wherever the central incisor teeth are well spaced and have erupted normally, and the halves of the palate are of equal height, examination will show that the septum is almost always straight. By appropriate treatment it is maintained that the normal eruption and spacing of the incisor teeth can be secured. By accomplishing this the dentist can save many a septum from deformity. Not only should normal eruption, spacing and occlusion of the incisors be sought, but the other teeth should be made normal in these three respects. This is important because the second great cause of the deviation of the septum is inequality between the two sides of the palate, and this is due in nearly fifty per cent. of the cases to the teeth. When it is not due to the teeth it is caused by asymmetry between the two halves of the head as a whole. Two of the three chief causes of deviation of the septum, therefore, can be prevented by dealing with the teeth.

The treatment of deviations brings up another practical question which is in the minds of all. This is, "How much can the septum be saved from deformity by widening the arch of the palate, and by so doing widening the nasal fossæ?" It is not new knowledge to the dentist that the nasal fossæ can be widened by widening the arch of the palate, but it is new knowledge to many physicians, even to many specialists. It is

easy to see how the old, cumbersome and uncomfortable split plate could widen the arch of the palate and at the same time widen the nasal fossæ, but it is not so easy for the lay physician to see how some of the modern methods are always sure to accomplish more than a change in the angle of the teeth and of the alveolus, and so an apparent, not a real, widening of the palatal arch. I know, however, from discussions which I have nad with dental practitioners, that the arch is really widened by the beautiful mechanical appliances employed to-day, yet I feel that a certain amount of exact data about their working is still to be accumulated. Granted that the width of the nasal fossæ can be increased by widening the palatal arch, the vital question remains, "How much?" Before this can be answered, the normal growth of the palate for any given year must be known. Likewise, the normal width and the normal increase of the width of the nasal fossæ must be ascertained. As the subejct stands to-day, the man who widens an arch adds the widening due to growth to the widening due to his apparatus and credits his appliances with both. This may be natural, but it is not exact. The information which I ask for can be obtained only by the cooperation of the nasal specialist and the dental specialist. I know that such work is already in progress. We shall all welcome the day when it is completed and the loose statements of the past are replaced by accurate ones. When this knowledge is in our possession we can say definitely how much the septum can be straightened by widening the arch of the palate. I believe that much good can be accomplished in this manner. I think that it will be found that what is accomplished is due more to the widening of the nasal fossæ, and to the consequent relief of obstruction, than to actual correction of the deviation. Frankly, I do not see how a deviation can be made straighter by this means. All that can be accomplished is to prevent its further increase. This, of course, is not to be considered unimportant. Before we can hope to obtain the exact information which, more than anything else, is to settle the question which I have just been discussing a considerable space of time must elapse. The obvious thing to do in the meantime is to correct every case of malocclusion, to widen every narrow arch, and bring it as nearly to the normal form as possible, and, above all, if you will permit me to say it, to guard the premaxilla from injury, and in every known way to strive to bring about the normal eruption, spacing and occlusion of the central incisor teeth.

## Summary.

The premaxillæ exert a very marked influence upon the form of the hard palate. In order to have a normally formed palate two changes must take place in the premaxillæ, they must shrink in size to the proper degree, and they must turn downward sufficiently. Failure of both changes to

occur results in the negro type of palate; a proper readjustment of position, but a failure of shrinkage, results in a high arch. The premaxillæ exert an influence not only upon the form of the hard palate, but also upon the line of the septum. I have been working upon the influence of the teeth upon the septum for the last year and a half. In this time I have seen over a hundred cases where the relationship between the teeth and irregularities of the form of the septum was demonstrable. My observations are readily summarized as follows: There are three great causes of deviations of the septum: trauma, irregularity in the eruption of the central incisor teeth, and inequality in the descent of the two halves of the palate. In nearly half of the cases where there is inequality between the halves of the palate the teeth are responsible. Therefore, it might be said that there are but two great causes of deviations of the septum, trauma and some irregularity in the development and eruption of the teeth. Delayed eruption of the teeth is caused in great measure by some disturbance of nutrition. When the eruption of one central incisor is sufficiently delayed it causes a deformity or hypertrophy of the premaxillary wing above it. This distorts the retaining groove made by the premaxillary wings. As a result, the septum slips from its bed in the vomer, and the groove made by the two leaves of the vomer spreads open, one leaf or side of the V disappearing. This produces a spur along the upper edge of the vomer. As the cartilaginous part of the septum slips from its bed the lower edge curls upward and outward, so that the lower portion becomes concave. Higher up on the septum this concavity gives place to a compensatory convexity. The convexity is generally toward the spur. On the side of the delayed tooth a short basal spur indicates the enlarged premaxillary wing. Deformity of the septum is often caused by asymmetry of the halves of the palate. This asymmetry shows in the nasal notches anteriorly and in the choanæ posteriorly and in the mouth. Such extensive asymmetry is due to unequal descent of the antra. Wherever the central incisor teeth are found to be well spaced (and by well spaced I mean neither too much nor too little space between the incisors), and the two halves of the palate are of equal height, the septum is almost always straight. By ensuring the proper eruption and spacing of the incisor teeth the septum can be saved from deformity. Normally erupted and spaced teeth, I am speaking now of all the teeth, mean, in a great majority of instances, a straight septum. After the teeth are fully erupted and in good line there remains no evidence of their delayed eruption except in the nose. Trauma, as well as delayed eruption of the incisor teeth, can displace the premaxillary wings and distort the vomer groove, resulting in spurs and causing deviations anteriorly and posteriorly. The best explanation for the slight anterior deviations which are so constantly found is some fault

in the eruption of the incisor teeth. Abundant dissecting-room findings prove that deviations so started may extend far backward on the septum and become obstructive.

## Discussion of Paper by Dr. Mosher.

**F. A. Faught, M.D., Philadelphia.**

Mr. President and Members of the Society: I think you will agree with me that a paper which is practically composed of pioneer work, hardly admits of discussion.

I believe that the point of the paper, reduced to a few words, is this: At last we have found the origin of probably the majority of deviations of the septum; at least those slight ones occurring in the anterior part, chiefly in the cartilage. It is also interesting to observe that in this key-note was contained the sequel to an investigation of two and a half years, and reported in part by me to the Section of Stomatology of the American Medical Association a year or two ago.

Dr. Mosher has first begun by clinically demonstrating the relation between the abnormal eruption of the central incisor and the premaxilla as it affects the position and normal straightness of the septum. Then he demonstrated anatomically that the changes he believes to be present do occur and produce the conditions of which he speaks. If we could now prevent the normal eruption of the central incisors and see the effect, our proof of this proposition would be absolutely conclusive.

Someone very recently, I believe Dr. Douglass, suggested the relation between the nasal spine, the wings of the premaxilla, and deformities of the septum. It took Dr. Mosher to determine the rest, and prove it. Dr. Mosher gives a complete demonstration of how the irregularity acts. An abnormal enlargement of one of the wings of the premaxilla is caused: the groove is destroyed and a sliding out and increased growth of the cartilaginous portion of the septum follows.

One question occurs to me: What is the relation of rickets in young children to septal deviations? Is the delayed eruption of the central incisors a part of the same process? We have enlargements of cartilage throughout the body in rickets: enlargement of the epiphyses of the long bones, etc. It seems that part of this enlargement may be due to a similar overgrowth of the cartilage of the septum. Up to the present time rhinologists have considered the correction and prevention of nasal deformities entirely in their province, but it seems to me that this will now have to be relegated to a great extent to the orthodontist. He has power to correct and prevent further deformity, and also by de-

termining the delayed eruption of the teeth and stimulating vital function, should be able to prevent the occurrence of septal deformity in many cases.

As to the separation of the intermaxillary suture, at a dental meeting in Philadelphia last spring, Dr. G. V. I. Brown demonstrated a method of spreading the two halves of the maxilla. His demonstration was perfect, but it did not take into consideration the trauma and pain attached to such work in children over seven or eight years of age. Dr. Mosher asks, "Granting the separation can be accomplished, the vital question remains, How much?" The conditions requisite for a trustworthy answer he has just stated, in words similar to my own, which I uttered more than a year ago, in discussing this same question.*

It may not be out of place to abstract from this article here. In closing I said:†

"In considering the effect of expansion methods on deviations of the nasal septum, it does not seem to be definitely recognized that these are really irregularities of only a part of this structure. They usually involve only the cartilaginous portion, and even when the bony part is included in the deflection, this rarely extends throughout the entire width of the bone. This fact has an important bearing on the success of this operation, as advocated by a number of practitioners at this time."

* * * * * * * *

"Expansion is believed by many to lower the floor of the nose, and, in so doing, to relieve pressure and exert a downward tractive force on the deflected septum. In view of the above facts, it seems almost unnecessary to state that, even if the direction of such a force were possible, it would be effective only in the rare event of a simple complete deflection. For if a part of the septum be already straight, as it usually is, this will effectually resist any straightening force which might reach it through the alveolar and palate processes."

* * * * * * * *

"To close this consideration of the subject at this juncture would undoubtedly leave the erroneous impression that most efforts to influence upper respiratory obstruction and mouth breathing favorably, through corrective measures applied to the teeth and dental arches, are of little,

*Read in the Section on Stomatology of the American Medical Association at the Fifty-eighth Annual Session, June, 1907.

†From *The Journal of the American Medical Association,* January 18, 1908, Vol. L, pp. 172-175.

if any, value. This would be the logical conclusion if the process were a purely mechanical one. On the contrary, we are dealing with vital tissues, possessing each a special function and capable of growth, repair and atrophy.

"It is a well-known physiologic fact that one of the most powerful stimuli to the proper development and normal function of any tissue or part, is the exercise of the specific function for which that tissue or part is intended."

* * * * * * * *

"Conversely, the inability properly to perform this function invariably results in either imperfect development or wasting and atrophy.

"It is natural then that we should find various alterations in the structure of parts of the whole upper respiratory tract. Thus may we account for the effect of adenoids, malocclusion, short-lip and tonsillar hypertrophy on normal nasal respiration and the production of the inevitable train of disturbances accompanying imperfect development of the bones of the face, particularly the maxilla and those forming the nasal passages.

"This also explains why the removal of exciting causes and the correction of existing deformities of contiguous parts gradually brings about a resumption of growth in these tissues, resulting in the production of normal nasal chambers and the return of norml nasal respiration.

"Possibly of equal importance in contributing to improvement after most corrective measures, is cell stimulation and renewed growth in the maxillary bones, through the irritation caused by the varying degrees of pressure applied to the teeth and alveolar arches. The extent to which this process may be operative is a matter not easily determined, and how far these two factors influence the conditions in a given case to the exclusion of others, we are, as yet, unable to determine, since up to the present time no practical or sufficiently accurate methods of observing and recording these changes have been devised.

"Without doubt, many of the results which have been attributed solely to the effect of definite movement of bone, and the resulting improvement in the respiratory capacity of the nasal chambers, are in reality instances of the beneficial results of stimulation of these vital functions."

Gentlemen, members of the American Society of Orthodontists, it remains with you to determine what the normal form and size of these parts at any given age are, and to devise, if possible, an accurate and practical method of measuring and recording the normal and abnormal in this region. By so doing you will furnish the necessary complement

to Dr. Mosher's work, by reducing the study and treatment of orthodontic conditions to a truly scientific and accurate basis.

**Dr. Matthew Cryer, Philadelphia.**

Dr. Mosher has spoken of the matter of the relation of the teeth and nose as though it had been but recently noted, but Harrison Allen thirty-five years ago wrote on this subject, and in his lectures in the Philadelphia Dental College in 1873, '74 and '75 he taught that in order to understand the correction of irregularities of the teeth you must understand the nasal chamber: to treat the nasal chamber you must know the occlusion of the teeth, etc.

The doctor has spoken with regard to the expansion of the arch by mechanical means. Now, since I read a paper some years ago on the "Occlusion of the Teeth," I have been a little afraid to give my ideas before this society. I will say this as an assertion: You can not spread the width of the floor of the nose by the expansion of the walls of the mouth; also, that you can not expand the arch of the mouth by expanding the teeth separately from one another. Take the dome of this arch and spread the walls out and you will not spread the roof, providing it has a proper suture. You may move the teeth apart, but you will never widen the maxillary bones.

**Dr. Rogers, Boston.**

There are one or two ideas I want to emphasize. Dr. Mosher has opened before us what is practically a new volume for observation. I had the pleasure of traveling last night with the doctor, and in our conversation I could see where our work overlapped, and that there were many possibilities of future development. We can see clearly where we stand at the present time, but the progress we shall make in the future is to me inconceivable. The relationship is so intimate between the teeth, the dental arches and the nasal cavities. If we can scientifically comprehend these things, and by the proper treatment of the temporary arches be able to prevent these deflections of the septum, as well as prevent nasal spurs, we will be doing a wonderful work. This paper is destined to be one of the factors to stimulate us to greater effort.

A great deal of the anatomy which Dr. Mosher has brought before us is new and hard to understand on this its first presentation, but to study this is our duty; we must in the very near future make ourselves proficient in a knowledge of this anatomy, for without it we can not expect to be successful in our work. Let us make ourselves absolutely proficient in the minute details of the anatomy of the parts surrounding the teeth.

**Dr. Ottolengui.**

I will just say a few words on one particular phase of the subject. I need not say that I consider this a very fine and helpful paper, but I

only wish to discuss the last part of it, which deals with treatment. The essayist raised a question as to whether or not we can help the nasal passages by methods of widening the arches. Dr. Faught spoke of some method of Dr. G. V. I. Brown, wherein he spread the maxilla apart by opening the suture, and Dr. Cryer tells us that we can not widen any portion of the dome by traction on the teeth. I agree absolutely with that dogmatic statement of Dr. Cryer's; also, I believe that you can not lower the vault by widening the arch of the teeth, because of the anatomy of the region above. Nevertheless, in young patients the maxillæ can be spread apart along the line of the suture. The suture can be opened, and very quickly—within three weeks—and it is not painful, contrary to Dr. Faught's supposition. I have done it many times without soreness in that particular part of the mouth. I was under the impression when I read a paper at the St. Louis congress, that this opening of the suture could not be accomplished with the expansion arch. I have since discovered, by actual experience, that the suture can be opened with the expansion arch. It is merely a question of the manner in which traction is applied. But considering the ease with which the teeth themselves may be moved, and that you would need to have more resistance in the tooth alveoli than along the median line, I believe, where there is nasal stenosis, it would be better not to make the attempt with the expansion arch, but to apply force high up in the mouth with the split plate, and open the suture in that manner. There are gentlemen present who practically know that, following orthodontic interference, there has been an increased nasal capacity. How can we make that agree with the statement just made? I believe we should not forget, in studying skeletons, that in life we are dealing with subjects where these bones are covered with soft tissues, and the cavities we are looking at are much smaller, in life, and that these soft tissues are subject to disease. Where there is mouth-breathing we are likely to have nasal stenosis, contributed to by a thickening of the membrane covering the bones. Orthodontic interference, by overcoming mouth-breathing, aerates the cavities and restores the tissues to normal; thus you have increased breathing space by reduction of the thickness of the soft tissues.

**Dr. Wilbur Dailey, New York.**

This subject, as Dr. Mosher has presented it to your consideration, has been prominent in my mind for a number of years. As early as 1905 I read a paper entitled "The Malocclusion of the Deciduous Teeth." In that paper I said: "I have found the most prominent cause of malocclusion is the imperfect development of the arches, and I call

your attention to the development of the premaxillary portion of the maxilla."

Answering Dr. Cryer, with reference to the canine tooth being called the "keystone." No architect would call attention to a keystone so situated, because the keystone is always situated in the median line of two lateral halves of the arch. You will see that the premaxillary bones act as a perfect keystone, from an architectural, as well as an anatomical, standpoint. The failure of this premaxillary portion to expand is responsible for the narrow arch, irregularities, and by reason of non-development teeth are forced either inside or outside the proper dental arch. The essayist has called particular attention to the distal surface of the lateral incisor tooth. The nares, in deficiently developed cases, compares almost identically with the distal surface of the lateral incisor tooth, and on the development of the premaxillary portion depends the size of the nares. When you have a deflection it is on the opposite side from where the development has taken place.

**Dr. Bogue.** I wish to confine myself to asking one or two questions. I shall be glad to know from Dr. Mosher whether he has, at any time, investigated the question of the enlargement of the arch of the deciduous teeth with a view to securing an aid in the development of the intermaxillary bones?

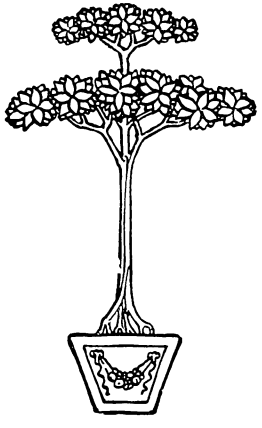
**Dr. Mosher.** I have not, I am sorry to say.

**Dr. Bogue.** I was hoping the doctor had instituted some experiments of this kind that might be brought before us here, as it seems an exceedingly important part of the question. The next question is, whether he thinks the separation of the superior arch, after it shall have been partly formed, would aid in straightening the nasal septum, either the cartilaginous or the osseous portion? The septum having slipped from its proper bed and become curved, would the separation of the two sides of the maxilla result in that septum resuming its proper form?

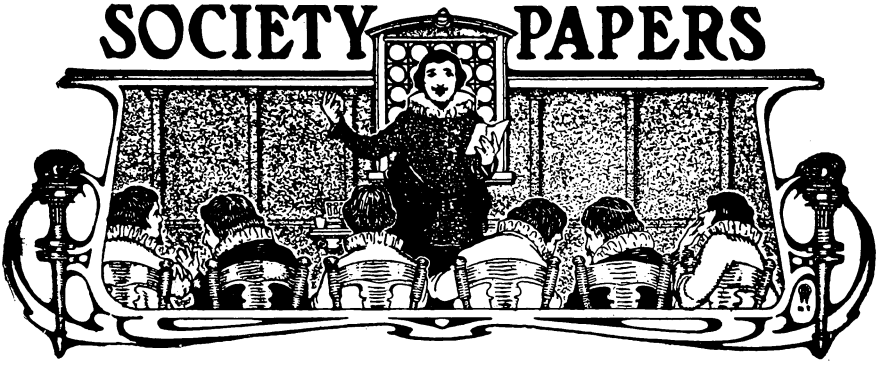
**Dr. Mosher.** Mr. President and Members of the Society: You have been kind to give me so much time. Dr. Faught was generous to discuss my paper at such length, and I have little to add. Dr. Faught asked if rickets could enlarge the premaxillary wing. I do not see why not. In reply to Dr. Bogue's last question, I do not see how the separation of the maxillæ, or any such enlargement after the deviation of the septum has taken place, will do anything except keep the deviation where it is.

**Dr. Bogue.** Vomer spurs are formed, as Dr. Mosher has shown us. There are differences of opinion as to what takes place a little later. Dr. Brown, of Mil-

waukee, believes the separation of the superior maxillæ will result in a descent of the septum later on, and Dr. Quimby, of New York, has held the same view, because both of them have had cases in which they thought it occurred. Dr. Quimby's case is his own daughter. He stated to me that he himself had applied orthodontic force—namely the screw, to spread his daughter's teeth. The girl was then about fifteen years of age. She came to him on one occasion and said, "Papa, what has happened to me? It seems to me my nose feels queer, and more air is passing than before." He found her central incisors about an eighth of an inch apart. and the nasal septum distinctly straightened. He was startled, and thought he had done something very bad. The clearer air passage has remained and the space closed up. He believes the same thing might have occurred in other cases.



# SOCIETY PAPERS



## The Structure of Enamel as Related to Cavity Walls.

By Frederick B. Noyes, D.D.S.

*Read before the Colorado State Dental Society.*

Mr. President and members of the Colorado State Dental Society: I am very glad to be with the society in this meeting and to come in contact with men who are stimulated by the grandeur of these mountains and the clearness of this atmosphere. If the country in which a man lives stamps characteristics upon his methods of thinking, certainly here one should add to broadness of view and width of vision from across the plains, strength, vigor and courage of thought, and richness of imagination from across the mountains.

In presenting this subject to you I am bringing nothing new, all of the facts have been presented before perhaps many times. They are old and tried. It is simply a statement of the rules of enamel wall preparation, not that they can always be realized, but that cavity walls are strong, reliable and permanent in proportion as they are prepared in accordance with these principles. I am making no apology for presenting the subject, for it was not my selection and no apology is needed. While I have worked on this subject for a long time, I still find that, after presenting it again, on returning to operations at the chair it becomes more and more constantly useful. While I know that you all know the facts of enamel structure, I hope that the slides may enable you to picture more perfectly in your imagination the structure of the tissue upon which you are working, so as to greatly facilitate operation and improve the quality of the result. No one has greater need to develop his constructive imagination than the dentist, for, in proportion as his mental images of the minute structures of the tissues and the steps of procedure, are clear, positive

and brilliant, his execution will be rapid and successful. The slow operator is slow because he does not know exactly what he wants to do, but putters and plays around until finally he thinks "that will do." The rapid and successful operator is rapid and successful because he has a perfectly clear mental picture of exactly what he intends to do, step by step to its completion, and the operation is executed with the precision and rythmical movement of a poem. When a cavity is to be opened up he sees not enamel, but a tissue composed of structural elements which

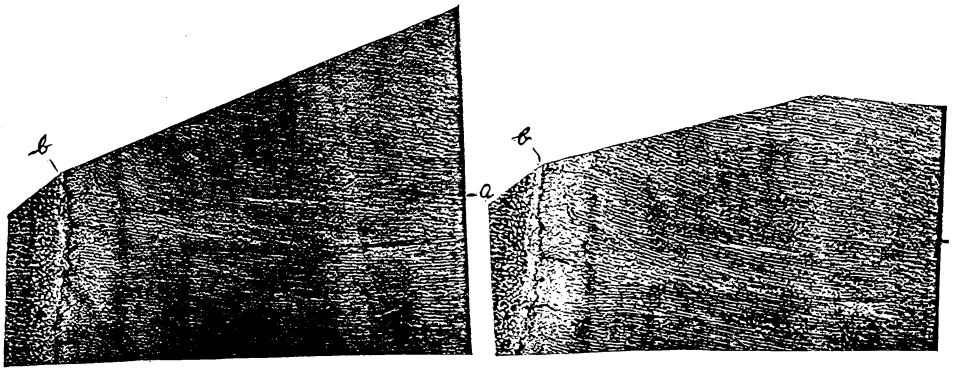



FIG. 1.

Fig. 1.—An incorrect enamel wall. The enamel plate rests on sound dentin, but the inner ends of the rods are cut off, leaving a portion above the line, b a, that is held together only by the cementing substance, and would crack or crumble in condensing against it.

will split and cleave in certain directions. When the cavity wall is to be formed he sees not a homogeneous substance hard as flint, but a wall made up of structural elements which must lie in certain ways if it is to possess strength and resistance.

The enamel is composed of two structural elements, enamel rods or prisms and cementing substance. Both of these structures are composed normally entirely of inorganic matter, but they are different both in physical and chemical character. The substance of the rods is stronger than the cementing substance, as is seen in sections both longitudinally and transverse where the cracking of the tissue will be seen to follow the lines of the cementing substance, here and there breaking across a few rods, but following their general direction. The cementing substance is

more soluble in acid than the substance of the rods, as is seen in caries. The acid formed dissolves out the cementing substance from between the rods and dissolves away their sides. These facts are absolutely fundamental.

While the enamel is extremely hard it is not elastic, and when not supported upon the dentin it will break through its entire thickness with ease, the fracture following the general direction of the rods. These

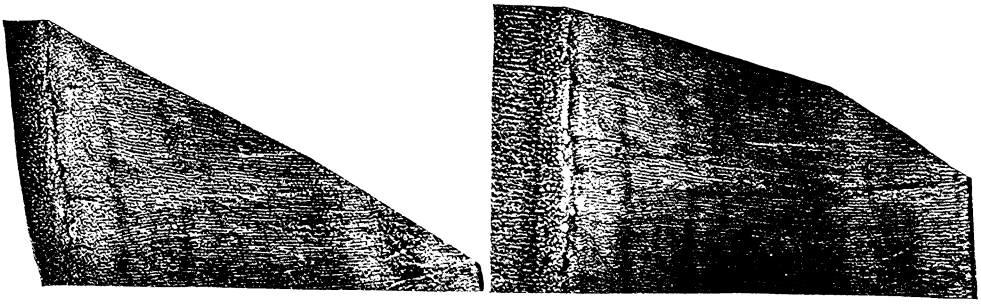


FIG. 2.

Fig. 2.—An enamel wall showing the support of the rods which form the margin by rods which rest on the dentin and are covered in by filling material.

a. The cavo-surface angle.

b. The enamel wall at the dento-enamel junction.

c. The point at which the rods which form the cavo-surface angle reach the dento-enamel junction.

facts are the basis of the true method of cutting enamel in the preparation of the enamel walls. Before considering the relation of the structural elements of the enamel to the cavity wall and the principles which must be observed if strong walls are to be produced, we must learn the use of cutting instruments in terms of the structure of the tissue on which they are to be used.

**Method of Using Chisels in Cavity Preparation.**

The chisel, or chisel-sharpened hatchet, is the instrument for cutting enamel, but it is used in two ways, and for any use they must be very hard in temper and keenly sharp. First, to chop or split off pieces. In this method of using the chisel the edge is placed close to the margin of the enamel at the border of the decay, the line of the shaft being inclined slightly farther from the cavity than the direction of the rods. The edge will engage the surface and sharp force

applied either by pressure or a tap of the mallet (steel preferred) will crack the tissue through in the general direction of the rods. In this way unsupported enamel is easily split, and even when resting on sound dentin the enamel can be split off piece after piece down the entire axial surface of a tooth if the rods are straight. To succeed, however, certain things must be accurately observed. First, the instrument must be sharp and

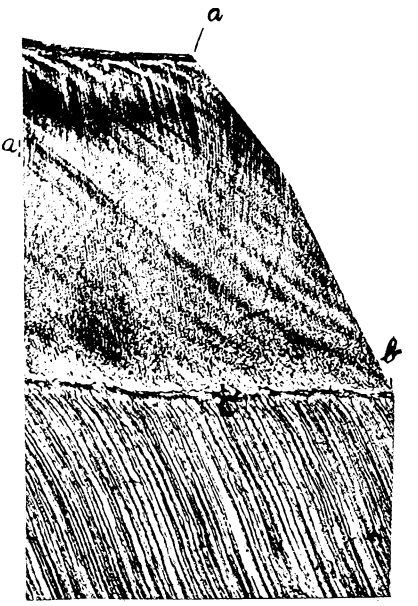



FIG. 3.

Fig. 3.—Two enamel walls which illustrate the structural requirements.

able to hold an edge; second, only a small piece can be chipped off at a time (about half a m.m. in width); third, the force must be sharp, strong and only at a slight angle to the direction of the rods. It is necessary, therefore, to know the direction of the enamel rods in all parts of the crowns of all the teeth. No matter how perfect the enamel, it can be rapidly removed if the dentin is removed from under it, and it is properly attacked, with a chisel or an instrument used as a chisel. This method of cutting enamel always leaves the structure of the wall more or less disturbed. That is, some rods are broken across and the cementing substance between others is more or less cracked. For this reason a cleaved enamel wall always looks more or less whitish because of the refraction of light

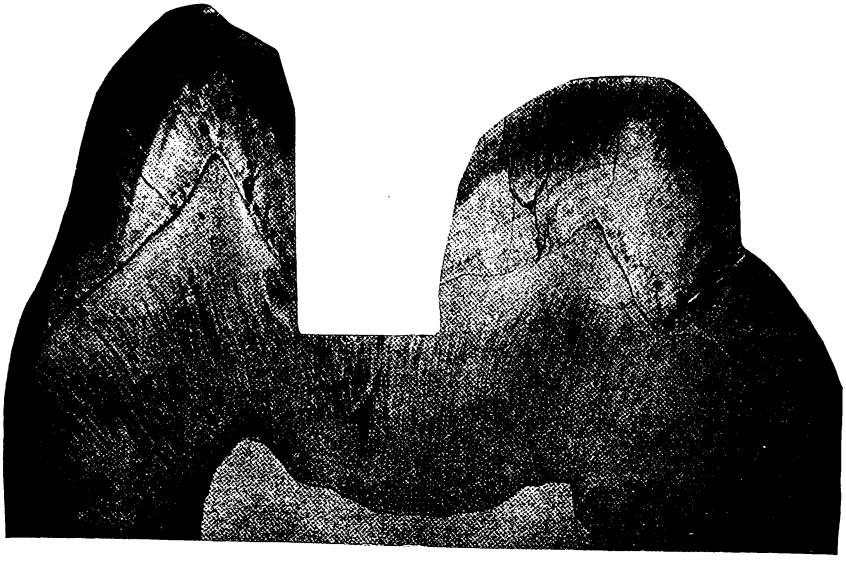


FIG. 4.

Fig. 4.—Enamel walls in an occlusal cavity in a molar.

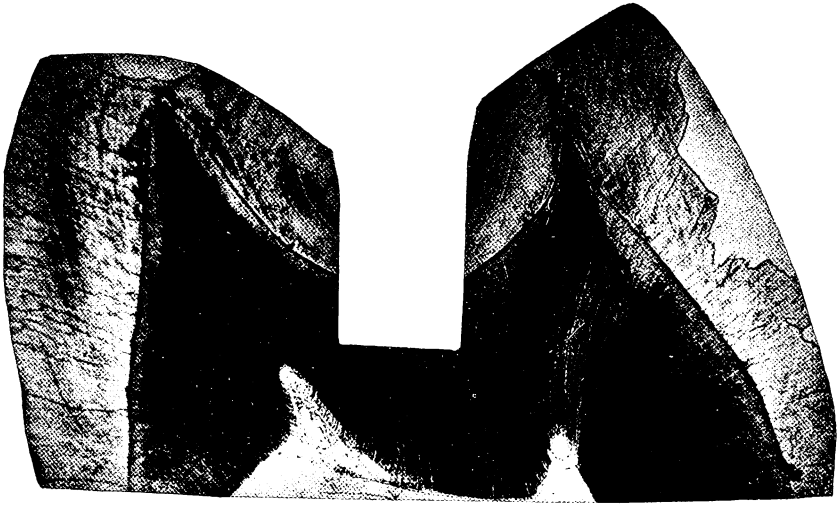


FIG. 5.

Fig. 5.—Enamel walls in an occlusal cavity in a bicuspid.

by the air in the cracks between the enamel rods. Therefore, after an enamel wall has been cleaved to the position required to give the outline form to the cavity it must be trimmed and finished by an entirely different method of using the chisel.

The second use of the chisel is to plane or shave the enamel wall without any reference to the enamel rod directions. In this process the blade is placed on the surface to be cut at a slight angle to the surface and applied with a sweeping or planing motion. In this way the tissue can be shaved, and in doing this the inclination of the entire enamel wall should

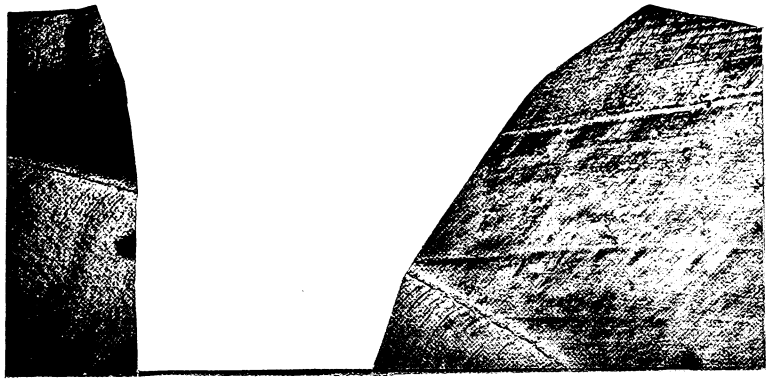


FIG. 6.

Fig. 6.—Enamel walls in a buccal cavity in a bicuspid.

be slightly increased. In doing this the whitish appearance of the tissue is removed and the enamel resumes its peculiar bluish translucent appearance. Until one has acquired the technical skill to use cutting instruments in this way, the intelligent preparation of enamel walls is impossible. The outline form of a cavity should be attained, therefore, by using burs to cut sound or hard dentin, chisels and hatchets (occasionally hoes used as pull chisels) to cleave enamel. When the outline form has been attained spoons are used to remove softened dentin, and the planing or shaving motion of chisels and hatchets to trim and finish enamel walls and margins.

The structural elements of an enamel wall must be arranged in certain ways in order to give strength, just as surely as the brick or stones and mortar of a mason's wall. The principles of the arrangements can be definitely and clearly stated.

1. The enamel plate must be supported upon sound dentin. If it is not, all the enamel projecting beyond the line of the dentin support is sustained only by the cementing substance between the rods and force upon this piece will easily crack the enamel through on the lines of the cementing substance. No substitute can be made to give the same elastic support as the sound dentin. Moreover, the enamel itself in such positions has been weakened by the solution of cementing substance from between the rods extending from the dento-enamel junction outward.

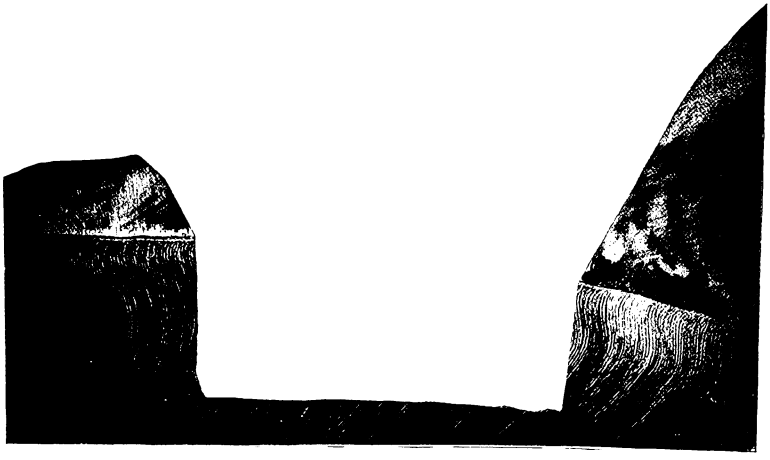


FIG. 7.

Fig. 7.—Enamel walls in a buccal cavity in a molar.

2. The rods which form the cavo-surface angle must run uninterrupted to the dentin. The first condition may be fulfilled and not the second, as illustrated in Fig. I. In this the enamel beyond the line of the last rods which rest on the dentin is unsupported and is held together only by the cementing substance, and while this may be perfect it is not strong enough to sustain force on its surface or the force required to condense gold against it.

3. The rods which form the cavo-surface angle must be supported by a portion of sound enamel, the inner ends of whose rods are supported by sound dentin and the outer abutting on the cavity wall, all supporting the mar-

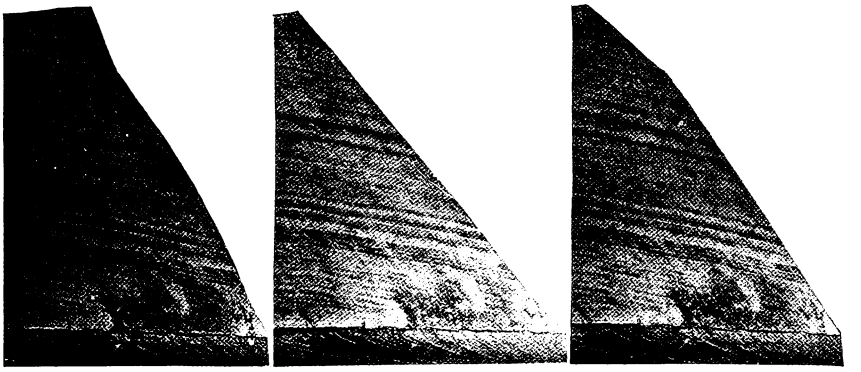


FIG. 8.

Fig. 8.—The preparation of an enamel wall in straight enamel, the rods inclined away from the cavity.

a. The wall as cleared.

b. The wall smoothed and the inclination increased.

c. The wall after beveling the curvo-surface angle.

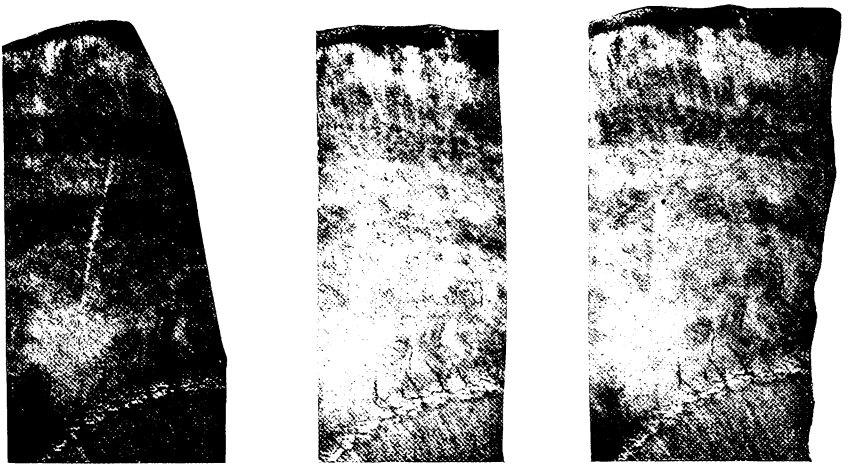


FIG. 9.

Fig. 9.—The preparation of an enamel wall in gnarled enamel.

a. The wall as cleared.

b. The wall smoothed, but short rods in the outer third.

c. The inclination increased and the cavo-surface beveled, completing the walls.

ginal rods like a buttress (Fig. III). This is the secret of strong enamel margins. In Fig. II it is seen that the rods which form the margin of the cavity at the surface extend to the dentin at *a*, and that they are supported by a triangular portion of enamel in which the inner ends of the rods rest on the dentin, the outer ends are covered by filling material;

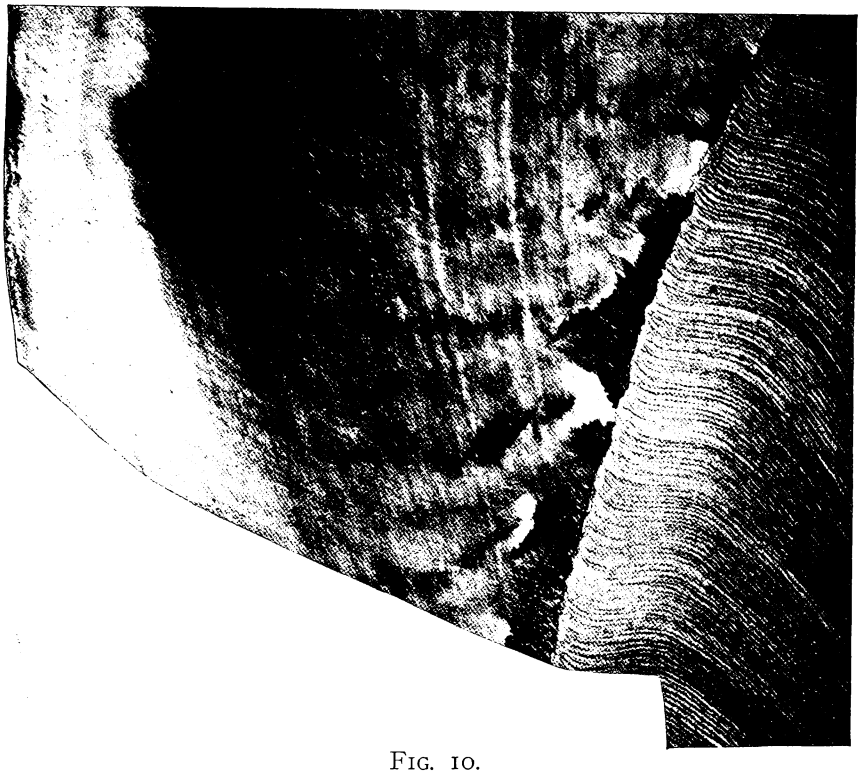


FIG. 10.

Fig. 10.—The occlusal wall of a buccal cavity in a molar. A good illustration of the structural requirements.

and which support the marginal rods against all forces coming on the surface. Reasonable force can be applied against such a wall without any danger of injury.

4. The cavio-surface angle must be so trimmed as to avoid danger of crumbling the angle. There are two reasons for beveling the cavo-surface angle, but first it may be considered simply as a means of avoiding the sharp angle. The four structural conditions just stated must be considered as the

principles which underlie the formation of strong enamel walls and margins. It must be remembered that they are principles. They can not always be prefectly attained, but, in proportion as they are carried out, the walls are strong and permanent, and, as we learn to observe them in the preparation of cavities, we find that we more and more often recognize that failures that have occurred in our own work and that of others have been caused by the failure to attain these conditions.

If we consider the general direction of the enamel rods in the plan of

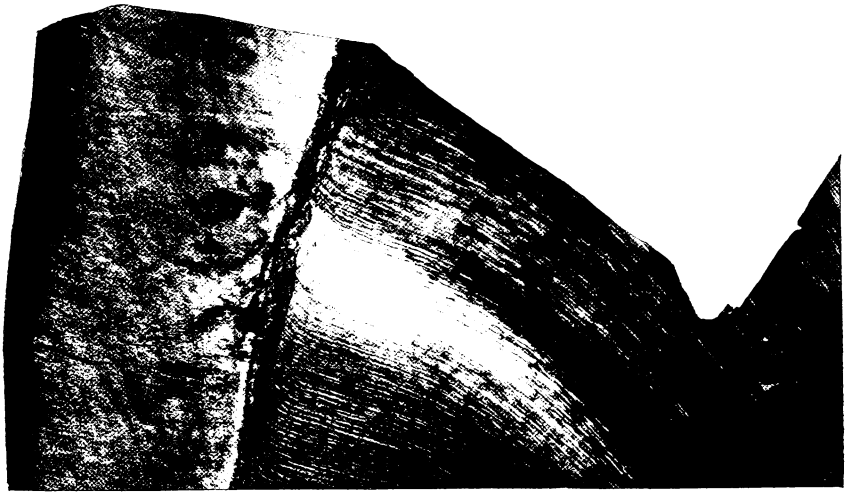


FIG. 11.

Fig. 11.—The gingival wall of a lingual cavity in a lateral incisor. A good illustration of the structural requirements.

construction of tooth crowns we at once recognize that there are two classes of cavities. First, those in which the rods are inclined toward the cavity (considering always the rods as extending from the dento-enamel junction outward), and, second, those in which the rods are inclined away from the cavity. The first class is characteristic of occlusal cavities and those in pits and grooves; the second, of cavities on smooth surfaces. It is also seen that in the first class it is easy to obtain ideally strong walls. This is fortunate, for the margins of these cavities are exposed to great force. In the second class it is difficult to obtain great strength at the margin, but the surfaces are not exposed to force, and it is necessary to obtain only sufficient strength to sustain the forces to which they will be subjected in inserting the filling. In the first class we

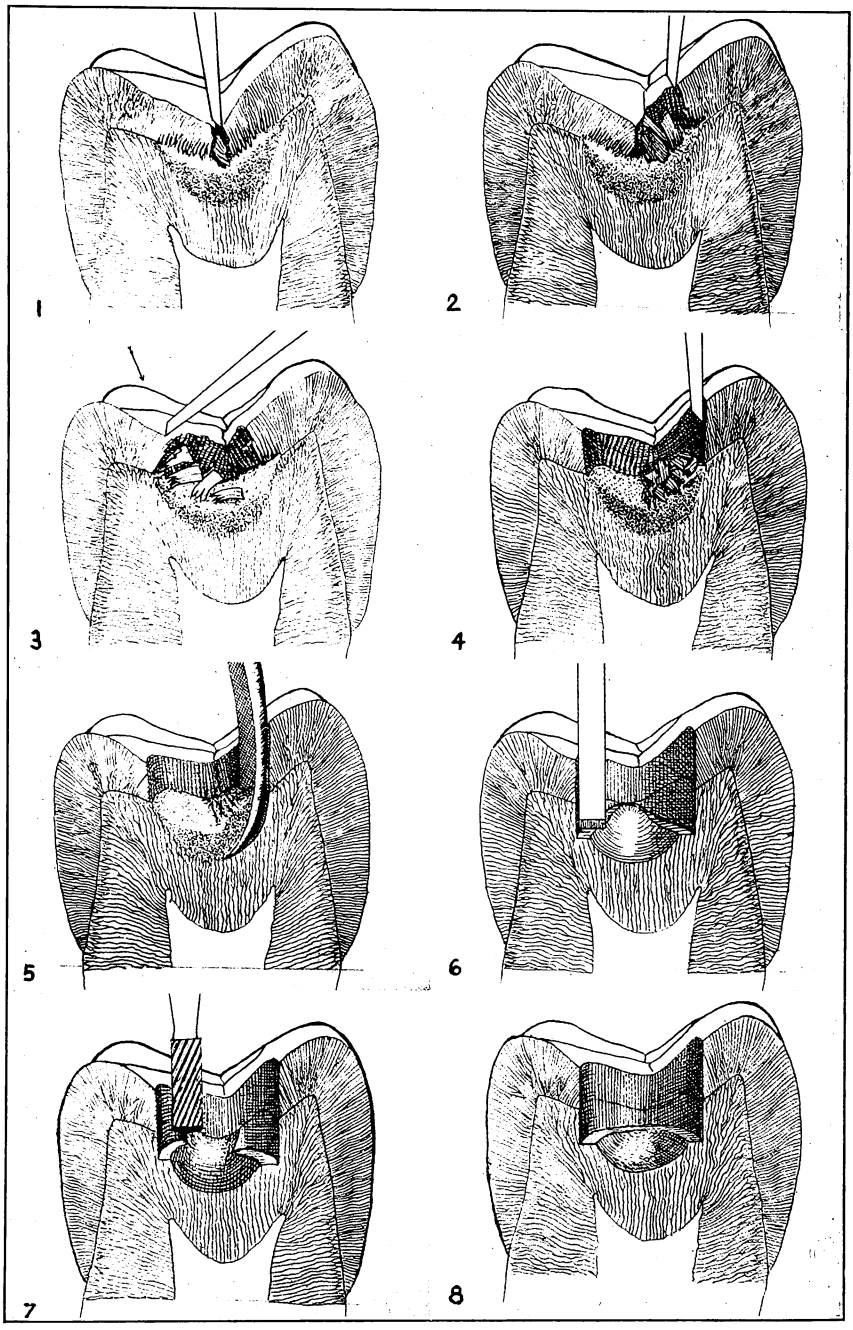



FIG. 12.

Fig. 12.—Illustrations from Dr. G. V. Black's "Operative Dentistry," illustrating the use of hand instruments in the preparation of a simple occlusal cavity in a superior bicuspid.

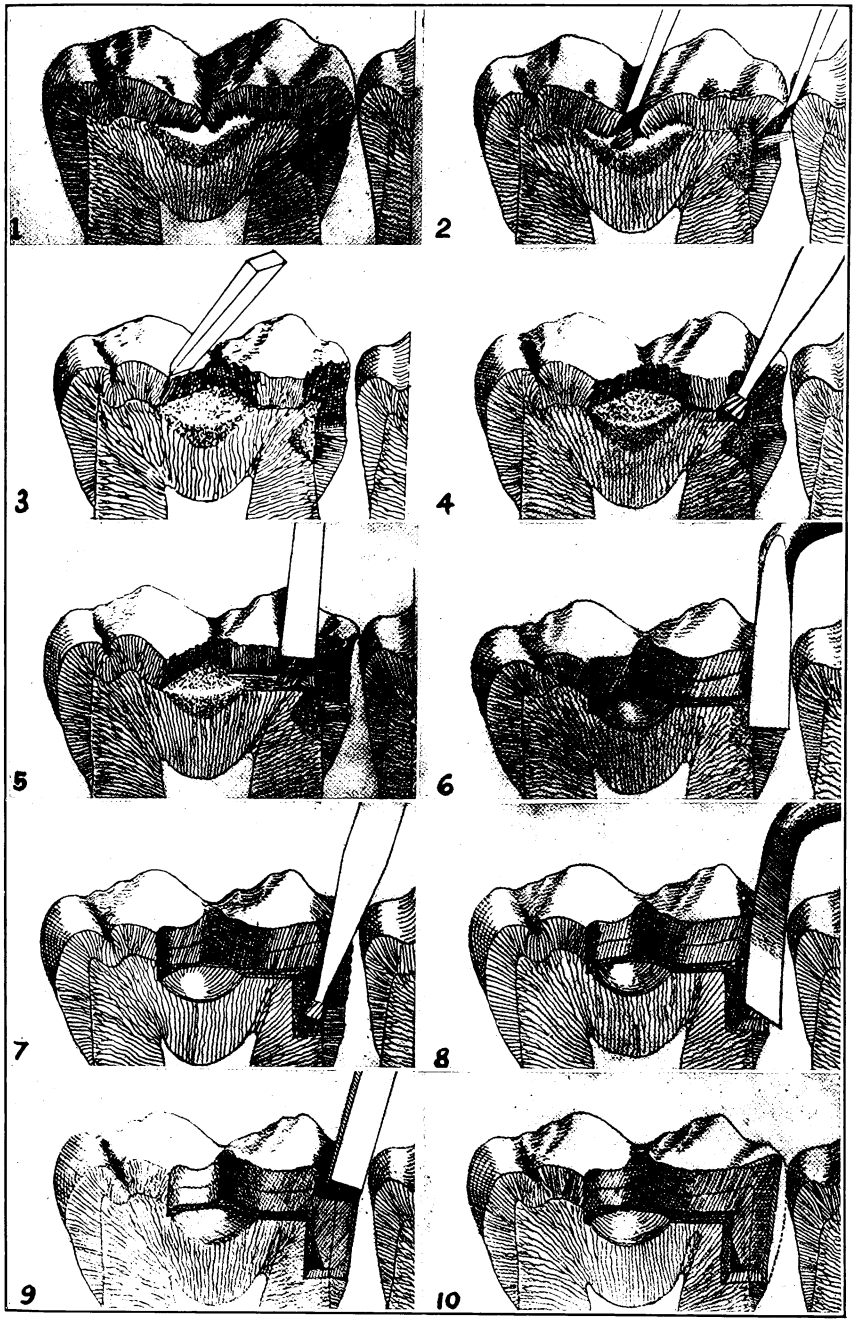



FIG. 13.

Fig. 13.—Illustrations from Dr. G. V. Black's "Operative Dentistry," illustrating the use of hand instruments in the preparation of a compound cavity in a molar.

require a bevel of the cavo-surface angle only when it is so sharp as to be liable to crumble In the second, we bevel the cavo-surface angle to support the marginal rods.

Now we may repeat by taking up those requirements one at a time as they would be applied in the preparation of any enamel wall.

Fig. VIII may be considered as a piece of enamel from an axial surface close to the margin of a cavity. The blade of a chisel is placed on the surface at a, and sharp force applied, either by hand or a sharp blow of the mallet. The enamel will split in the line indicated and the piece be caved into the cavity; the next picture represents the wall as it would be left. Now, with the planing motion of a chisel or hatchet the wall is smoothed and at the same time the inclination is slightly increased. This a little more than reaches the enamel rod direction and removes the portion in which the structure has been disturbed by the fracture. Finally, in order to support the marginal rods, the cavo-surface angle is beveled and the wall is complete.

The next illustration shows the same procedure in twisted enamel characteristic of some occlusal positions. After the first cleavage it is seen that quite a piece is left with the inner ends broken off. This would be found by feeling of the edge with a chisel and the inclination of the wall increased so as to remove them; then the cavo-surface is beveled to protect it and the preparation is complete.

We may use a set of illustrations taken from Dr. Black's book to illustrate in detail the use of hand instruments in the preparation of cavities. The first series (Fig. XII) shows the steps in the preparation of a simple occlusal cavity in a bicuspid. No. 1 shows the decay as it appears in section. The chisel is placed close to the buccal margin and piece after piece cleaved off until the support of sound dentin is reached, and this is repeated in all directions until all undermined enamel has been removed, as shown in the following pictures. Then, with a planing motion, the walls are shaved down until they are in the axial plane. The softened dentin is now removed by starting a spoon excavator at the dento-enamel junction and the axio-pulpal angles are squared with the chisel, as shown in No. 6, or with a square end bur, as shown in No. 7. It will be seen that the bur may be used on the enamel wall, but when used there it acts as a revolving chisel.

The next series shows the preparation of a compound cavity in a molar. The occlusal portion is opened as before and the proximal portion as indicated, beginning at the margin and cleaving off all undermined enamel. When this has been done a strong piece of enamel resting on sound dentin is left separating the occlusal and the proximal cavities. A small inverted cone bar is started in the dentin just below the dento-

enamel junction of the occlusal enamel on the proximal side and by bringing it upward the enamel is torn up from within outward until a little ditch is cut from one cavity to the other. As soon as this is done the enamel can be cleaved away toward the buccal and lingual, piece by piece, and the outline form obtained. The gingival wall must now be carried gingivally—this is done by cutting out the dentin with the bur and cleaving the enamel until the entire outline form is obtaned. Fnally, after retention form is made in dentin with the bur, the margins are trimmed and beveled wth the planing motion of the hatchet.

The structural requirements that have been stated must be regarded as fundamental principles. In operating conditions may arise where it is impossible to perfectly fulfil these requirements, but we must be perfectly sure that wherever they are ignored there will be corresponding weakness and unreliability in the operation. I am fully convinced that there is nothing that will do as much to increase a dentist's ease, rapidity and success of operation as a minute study of the structure of the enamel.

---

## Lost Castings---Causes and Remedies.

By F. H. Nies, D.D.S., Brooklyn, N. Y.

*Read before the Second District Dental Society, February,* 1909.

Molding and casting were practiced by the ancients. Evidences of such work appear in the neolithic age of all nations. The Babylonians and the Egyptians practiced the art about five thousand and four thousand years before Christ. In a royal tomb at Abydos, in Egypt, four bracelets of gold, showing a mastery of casting and soldering, were found on the arm of the Queen of Zerta, who lived 4715 to 4658 B. C.

The method of molding and casting now used by dentists in making bridges, inlays and crowns, is a revival of the process employed by the celebrated Italian goldsmith and sculptor, Benvenuto Cellini, who flourished in the early part of the sixteenth century. In his treatise on goldsmithing and sculpture he gives a description of his method for making hollow figures.

**Casting Methods of Benvenuto Cellini.**

"I made a model of clay," says he, "just the size the figure was to be. This done, I estimated that the shrinkage would be about one finger thickness, so I very carefully went over the whole, touching it up and measuring it as the art directs; then I gave it a good baking, and after that I spread over the whole an even coat of wax of less

than a finger's thickness, similarly adding wax where I thought it needed it, or even taking a little away from off the waxen coat that was over the whole. This method I pursued until I had completed it with infinite diligence and care."

He goes on to say that the model is carefully coated with a paste formed of plaster and fine brick dust combined with a mixture containing alum and salamoniac. The model is now suspended by a wire in a box which is filled with the same mixture until the model is embedded. A wooden peg is placed to indicate where the channel or gate can be most conveniently made. When the mixture sets, peg and wires are withdrawn. The holes left by the wires serve as vents during the casting. The mold is gently dried, and the investment raised nearly to a red heat. This melts out the wax, some of which is recovered through the air hole or gate, while the remainder is lost. The molten metal is then poured into the space vacated by the wax. When the metal is cool, the molding is carefully broken away, the casting removed, and the core scooped out, thus producing a perfect hollow casting.

In making a solid casting he omitted the clay core and made the model entirely of wax, which, after investing, he melted out and replaced with molten metal. If we compare this process of Cellini's with the one we practice, we find very little difference. He showed us how to produce a hollow casting by the use of a core of clay; in our inlay work, cores of cement, investment material, graphite and gutta-percha are commonly used to produce hollow inlays. His careful modeling in wax corresponds to our modeling of cusps, contours and occluding surfaces in the same material. His coating of the model with paste is similar to our investment material. The alum he added to harden the plaster; the salamoniac as a purifying agent, or flux, to act upon the metal and prevent the formation of oxids. We use borax to-day for that same purpose. The model suspended by a wire in a box would be necessary now in a large casting. The investment box is like our flask. This he filled with investment compound, as we do, until the model is embedded. His wooden peg corresponds to our sprue, and was placed to indicate where the channel for the inflow of molten metal should be. The melting out of the wax, the drying and the casting, are similar to the processes we daily use.

Although one is forced to believe that the *process* used in forming the modern inlay is old, still I firmly believe that the cast-gold inlay is new, and is the invention of Dr. Taggart, to whom we owe so much. Had he simply claimed in his patent a cast-gold filling instead of trying to cover his invention with a process patent, and claims on his casting machine, he would have had a valuable basic patent, and with it could

have prevented any one from making that cast filling, no matter what kind of machine he used, nor what process he employed, unless he paid a royalty or obtained permission.

Notwithstanding this error of judgment, I am firmly convinced that the courts, considering the overwhelming proof of priority, will broadly interpret Dr. Taggart's claims to the cast-gold inlay. Few inventors have ever asked a smaller royalty—merely the purchase of a machine. I wonder if the profession realizes that Dr. Taggart *could* exact a royalty of ten per cent. of all profits we earn from the insertion of cast-gold fillings! If the courts sustain him, he or his agents can summon any practicing dentist to produce his books and charts in an action for an accounting on royalties due from the day his patent was granted. You can not patent a new use of an old device or process; but you *can* patent a *new* article, even if made by an old process. I have learned in the school of bitter experience that it is a mistake to patent a machine for making an article. Patent the article! There are always numerous ways of accomplishing the same object.

**Effects of Pressure upon Fluid Metals.**

The conception of the compression of fluid metals was probably first introduced by James Wood, a well-known engineer and millwright, of Lancaster, England. He used this process in making printers' rolls of copper, from 1856 to 1859, at the Broughton works, Manchester, and at the works of J. Wilkes & Son, Birmingham. He is said to have shown his method to Sir Joseph Whitworth, who later embodied it in what is known as the Whitworth process, extensively used abroad. The previous process had been to cast the steel into ingots or molds which took the shape of the pattern. These castings often contained blow-holes, produced by the retention of air and gases. To rid the cast metal of these defects, the Whitworth process subjected the fluid steel to the heavy pressure of a hydraulic press until completely solidified, thus producing a metal which, for compactness, density, ductility, and strength, is almost equal to a forging. A pressure of twenty tons is not uncommon, and a column of fluid steel, Whitworth states, shortens one and one-half inches to a foot while solidifying under this pressure. This gives one a good idea of the value of this process in securing a dense filling. Thurston, an able authority, writing on mechanical treatment of metals, says: "this effect is due to *that* change of volume, *density* and condition of *molecular aggregation* which is produced by any action *causing flow* while under stress, and *especially* while under *compression.*"

Applying this principle of pressure casting to dentistry—to the various devices we daily use in restorations—we find it calls for an intimate knowledge of the action of our molten metal, investing material,

and the machine with which we are working. It is possible to make many of the machines on the market do successful inlay casting by carefully noting failures and seeking the cause. Nearly all failures are caused by *negative pressure* in one form or another. Briefly, they are due to shrinkage of investment material; expansion of the metal ring, or flask; too dense an investment or one that is too friable; under heating; overheating; improper combination of physical and chemical properties in investment formulas; insufficient air; gas or steam pressure; insufficient fluidity of ingot; improper gaskets and washers; or too large a sprue hole.

All these, and perhaps others that I have failed to mention, contribute to the many failures that often spoil our best efforts. To analyze the causes of negative pressure and other failures, and, in a measure, to supply remedies, is my task this evening.

**Investment Materials.**

We all lose castings through the shrinkage of investments, because the shrunken investment no longer fills the flask, and the air, gas or steam escapes between the investment and the ring when pressure is applied. It is absolutely necessary to have the pressure *sealed*—so that it can not escape—that it may be exerted on the molten nugget and pressed down upon it, instead of escaping between the metal ring and investment, or through a poorly adapted gasket on the pressure plate. To prevent this escape we must have an investment material that does not *contract* when heated, and a metal ring or flask that does not *expand* when heated.

Many formulas have been published that are said *not* to shrink, and are marketed under many names. Dr. Price, in a series of able articles which appeared in the May, June, and December ITEMS OF INTEREST, publishes a chart of the shrinkages of the many marketed investments, conclusively proving *theoretically,* that for the purpose intended these products, owing to shrinkage, do not meet the requirements, and introduces in their stead the stone model. Have practical tests of the profession borne out these conclusions, or is it still an open question? Is the stone model practical with all casting machines?

A formula which seems to have a minimum amount of shrinkage is that of silex, four parts; plaster, one part. In these formulæ I refer to cup measurements, not weight. This proved a good investment, but too friable. I found this formula improved by the proportions three of silex and one of plaster. This was less friable and the shrinkage no greater. *The change to a new barrel of plaster sometimes completely alters the physical properties of an investment material.*

Another excellent formula is plaster of Paris, two parts; French chalk, two parts; Portland cement, one-half part. This gave a harder investment; but the shrinkage, though it did not apparently affect the fit of the casting, made it expedient to use it in a manner that I shall explain later. These formulæ, which are typical of many others, show plaster of Paris as the binding material, with chalk or silex added for the purpose of preventing it from being fluxed by the high heat necessary to fuse gold and to prevent shrinkage, if possible. We have been cautioned not to overheat our investment material, for some men claim they invariably lost a casting that was overheated. This frequently is due to shrinkage only; the overheating was only an *indirect* cause. The *actual* cause was shrinkage—due to heating—which *allowed* the pressure to escape between the investment and the ring, thus producing negative pressure. To remedy this frequent cause, those using the common ring of uniform diameter should first thoroughly heat it, place a small piece of cotton or moldine over the sprue hole to prevent dirt getting in, and proceed to pack the investment next the ring in the manner which I show you, thus making a tight joint.

I believe the investment material should be thoroughly heated; success is more certain when this is done. Thorough heating makes the investment more porous and allows through the porous investment the dispersion of air that might be occupying the place of the wax model. *Heated,* it does not immediately *chill* the molten gold, but often allows pent air in a dense investment to escape beside the molten metal as it comes through the sprue channel. This is often seen in the separated column of gold. The gold, filling the space left by the wax model, displaces a bubble of air which, in its effort to escape, separates the molten column.

*Underheating* a mold is at times the cause of a lost casting. The heat generated in melting the gold causes steam to form in the investment, which, forcing its way out through the sprue hole as we attempt to drive the molten metal in, nullifies the pressure. A cold or damp mold frequently causes the metal to recoil (or spit up), thus forming imperfect edges by its failure to lay up against the mold. A cold mold is denser than a heated one, and does not allow the dispersion of air through the investment material.

Castings are also lost by overheating. If heated too much or by too powerful a flame, the molten metal is liable to fuse the plaster, and the fluxed plaster passes into the mold as a slag, thus preventing a perfect adaptation of the metal. It also has the disadvantage of causing the fused plaster to adhere to the inlay, making an unclean casting. This can be remedied, however, by coating the wax with black lead before investing.

Large castings, such as *plates* and *bridges*, should be thoroughly and uniformly heated till they glow, and cast while very hot. This is necessary, for were they cast into a cold mold, the metal would speedily chill before reaching the extreme ends.

**Flasking Rings.**

Granting we had found an investment that did not shrink, in order to prevent negative pressure, we would need to find a metal ring or flask that will not expand under heat. We frequently lose castings through this cause, and often fail to recognize it. This was impressed upon me while watching a mechanic at a recent dental manufacturers' exhibit. Although a good investment was used, as the pressure plunger

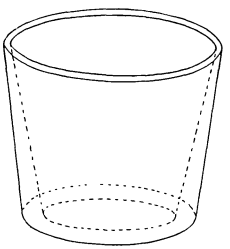


FIG. 1.

came down, there was a hissing sound that denotes the escape of air, carrying with it some of the powder that formed the investment compound. This should not occur. No gas, air, or steam should escape from the bottom of the flask if the inlay is to be perfect, because this hissing and blowing out of dust from the base indicates negative pressure. Examining the cast sprue of these cases usually finds them contracted and thread-like, insead of a faithful reproduction of the pattern. To remedy this fault of *shrinkage* and *expansion* of the *metal ring,* I have devised a *tapered ring* which I have never seen used before, and I have found it a great help in getting positive results (Fig. 1).

The inlay investment is allowed to come almost to the top of the small end of the flask. After thorough drying and heating it will be found that it is now possible to push the investment so tightly into the ring that any air, gas or steam is effectually prevented from escaping between the flask and investment. This tapered flask at the same time affords stability and support, and prevents the investment from being split asunder by too great a pressure. There have been times when I have been able to reassemble a broken investment in this ring and

secure another casting from the same mold. Without some such device the casting of full plates, thin and light enough to be worn, would be a difficult task. I found in a large full-case investment the shrinkage was so great without this flask, that it was next to impossible to hold the air between the investment and pressure plate, so that its pressure would be exerted on the molten gold. In large castings it is also necessary to support the investment on all sides, otherwise it would be broken to pieces.

**Other Causes of Failure.**

We must also guard against too dense an investment—as Portland cement and plaster, for instance. These materials, without thorough venting, were failures. The danger of too friable, or frail, an investment is also a frequent cause of lost castings. Friability is sometimes due to failure to properly mix the ingredients. The perfect pharmaceutical mix is made by first putting all powders in a large mortar

FIG. 2.

and rubbing them together. They should then be passed through a fine sieve, collected and returned to the mortar for another mixing, then passed again through the sieve.

The breaking away of corners and projections in the mold by rough handling, or the inflowing metal, frequently spoils a cast. Sometimes this is also due to injudicious coring for retaining points or cavities. I have saved many possible failures in these cases by the use of the oxy-phosphate of cement core, and the black lead point core. When I use the investment as a core, I try to place my sprue in a position where the inflowing metal, as it enters the mold, will not carry it away. It is highly important that the wax model be so mounted that the brunt of the inflowing metal is not projected against the sharp and frail angles. To make an oxy-phosphate core (Fig. 2), I hollow out the inlay by cutting out the wax with a bur, removing the debris with a camel's-hair brush dipped in alcohol. I then mix some oxy-phosphate and fill the hole, allowing a spur of it to project out far enough for my investment to take hold, investing and casting in the usual way. Where the corners are friable, or the lines very delicate, I use cement. In casting the detached post-

crown, which I am about to show you, I often use oxy-phosphate to give the perfect lines needed in making this kind of a crown.

**Crown with Cast Base.**

This crown is made by selecting a diatoric incisor tooth of proper size and color. The holes for rubber are filled with porcelain and baked. Grooves are then cut on both sides, forming a dovetail back with greatest width at the cutting edge. The root is prepared in the usual

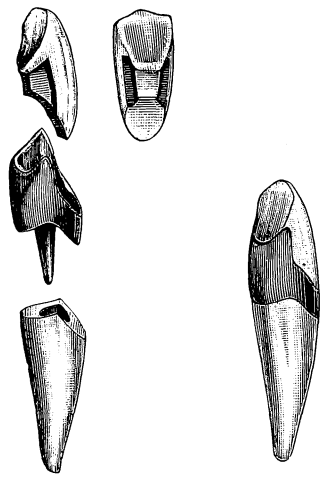


FIG. 3.

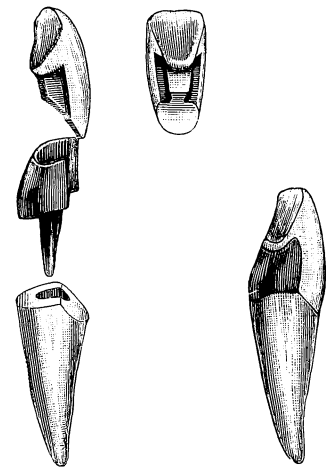


FIG. 4.

Fig. 3.—Gold shows at gum margin.
Fig. 4.—Facing adapted to root end direct, no gold showing.

way; a dowel of *sticky wax* that has been oiled and chalked is pressed in and adapted to perfectly fit the root canal, projecting out one-fourth of an inch. This projection is softened by heat, and the facing, which has previously been coated with a film of chalk, is pressed into this soft wax, chilled and removed together. The superfluous wax is trimmed off, the crown and wax dowel refitted to insure perfect adaptation, and then removed and mounted on a sprue, the end of which should be concentric, to fit the wax post in the manner shown in the illustration (Figs. 3, 4, 5, and 6).

**Casting with Steam Pressure.**

Failures occur through lack of sufficient gas pressure (Fig. 7). The blast of too great a volume of gas on the molten gold sometimes drives it away from the sprue hole. The gaskets on the pressure

plate sometimes fail to form a tight joint. Where a moist pad of wet asbestos paper or cloth is used to generate *steam* for pressure, care must be used to see that the pad is moist, but not too soft; that the investment be not too deeply sunk in the flask, for if it were, steam would only be generated where the hot ring comes in contact with the wet pad, and there would not be steam enough generated to fill the space left by a deeply sunken investment. To remedy this, I use a more shallow flask cover which brings my investment much nearer the surface; but when I use those on the market, I always place a flat wire-coil on top of my invest-

FIG. 5.

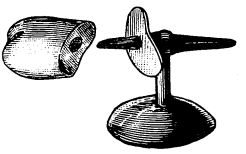


FIG. 6.

Figs. 5 and 6.—Cast bases for crowns.

ment, as soon as my gold is soft, heating all together (Fig. 8). As I apply my pressure plate with moist pad, it comes in contact with the red-hot coil and gives me a large steam-forming surface. A metal washer will answer the same purpose when the gas flame is used for melting. When using nitrous oxid, or oxygen, I use nickel for this purpose. It is not advisable to allow the molten nugget to give up its heat to generate steam, as it naturally would without the wire metal coil. Neither is it safe for the investment to come in contact with cold pad or cold gas, for the unequal contraction caused by the sudden chilling will sometimes crack the investment asunder, much as a hot chimney is cracked by throwing cold water on it. Hot water should be used to moisten the pad.

Many castings are likewise lost by not heating the gold enough. It should be boiling hot, and 24 k. gold can not be heated to this condition without the aid of an oxy-hydrogen blowpipe, or oxygen in some form. Many of the inlay machines using ordinary gas require gold of low karat to get successful results. Dentists purchasing these devices under the supposition that 24 k. gold is being used, are simply tricked; for casting in pure gold with them is seldom successful. Care in the use of borax should also be exercised. Do not use too much, for a liquid slag is formed that is apt to run into the mold with the gold, and occupy space

where the gold should be. It is safer to cleanse the gold in acid, and lastly in bicarbonate of soda preparatory to casting.

To prevent the plaster of Paris in the investment being fluxed by too hot a flame, I have devised the charcoal hardwood crucible (Fig. 9). The glowing charcoal maintains the gold fluid in the interval when the blowpipe ceases to play on the metal, and the pressure-plate is coming down upon the flask-ring. It thus enables one to fuse gold of high karat.

**Repairing Imperfect Inlays.**

I have not spoken of castings found short at the cervical end. This may result from imperfect impressions, due to failure to use a matrix of steel or celluoid to supply missing walls. These defective

FIG. 7.

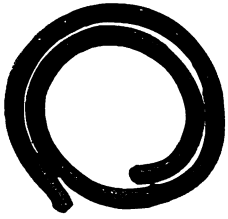


FIG. 8.

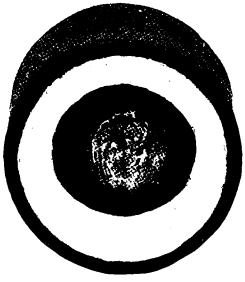


FIG. 9.

inlays, though seemingly lost, may be made good by repair in two ways: first, by burnishing matrix rolled-gold foil, gauge 30, against the tooth as if making a matrix for a porcelain filling. A little wax is melted where the shortage occurs and the inlay pressed to place in the cavity. Inlay and matrix are now chilled and removed together. Wet chalk is placed on the inlay to prevent the solder flowing where it is not wanted. It is now invested and gold melted into the space between inlay and matrix. I also use moss fiber for repairs. A piece of proper size is placed against the missing wall and the inlay pressed home. Both are removed together and gold solder melted on the moss fiber. This need not always be invested, but should be coated with chalk to keep the solder in its place. I know of no better way of wiping out the cement line when it seems likely to appear, than by using a thin layer of moss fiber, sandwiched between the tooth and inlay after both have been coated with cement. I have not found that it weakened the adhesion of the inlay to the cavity wall.

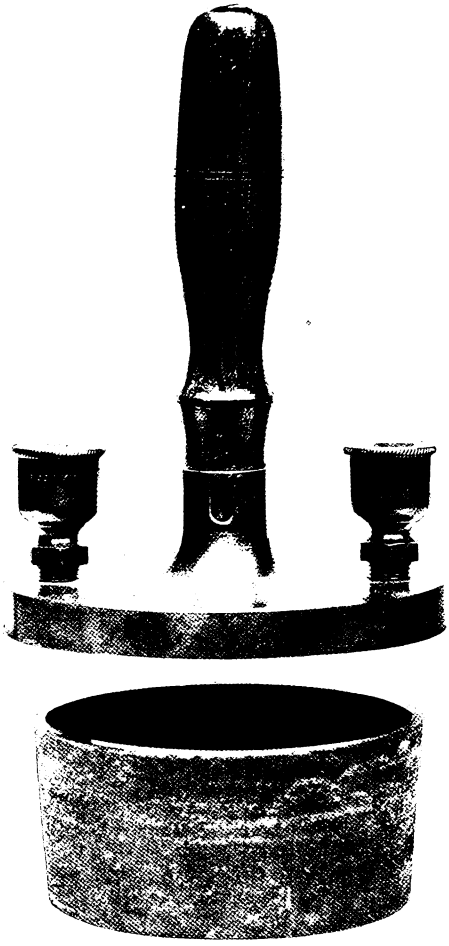


FIG. 10.

**Casting Full Dentures.**

Full metal dentures are cast in the flask which I show you (Fig. 10). The cover is lined with asbestos, to create steam. The little cups, seen in the illustration, hold water, which thus keeps the asbestos pad wet. I especially wish to call your attention to the cast-aluminum plates (Figs. 11 and 12). I do not know of the pure metal having been cast before under pressure, although the metal alloys have been used for many years. This metal has the advantage of being eight times lighter than gold, having many of its advantages, with none of its dis-

advantages of cost and weight. Casting may be done directly on the invested model, or the waxed plate may be removed from a model that has been previously oiled and coated with French chalk. The waxing up is done preferably in pink paraffin wax, carving the rugae to nearly the end of the plate. Thus planned, they act as corrugations and stiffen the plate. The sprue or gate may be attached directly to the center. Density

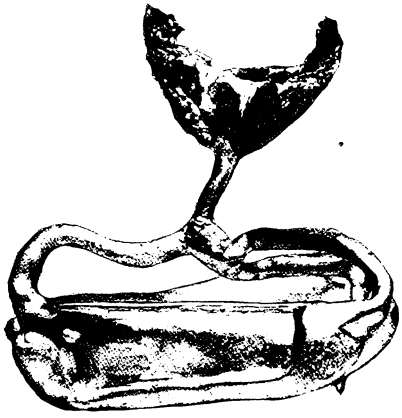


FIG. 11.

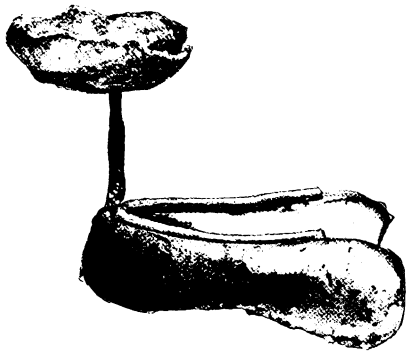


FIG. 12.

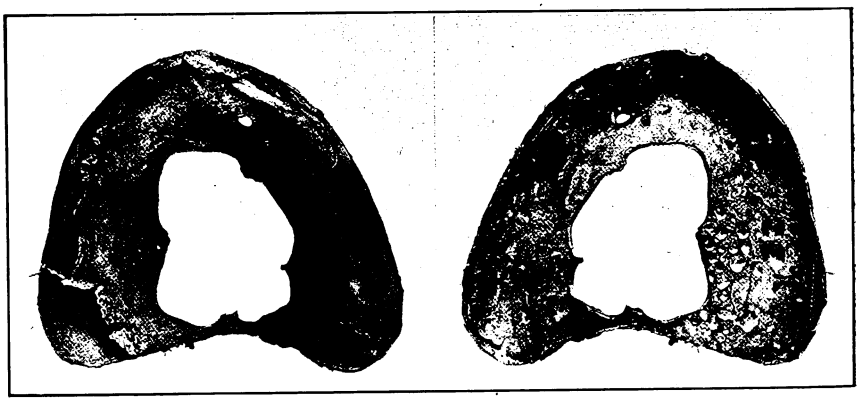


FIG. 13.

FIG. 14.

in the metal can be obtained by casting with a vertical side runner, so that the metal enters the mold from below and solidifies under the weight presented by the vertical height of the runner. In these large castings the sprue hole or gate should not be too large, for at times the weight of a

larger mass of metal is heavier than the force of cohesion, the result being that a small portion of fluid metal is forced into the entrance of the gate where it stops up the entrance to the mold. The models should be made of one of the various investment mixtures, if cast on directly. I have not yet been able to cast a gold plate that would fit, but I hope to succeed by using Dr. Price's artificial stone for this purpose. It gives a dense, hard model that withstands any heat. The phosphoric acid in this mixture, however, sets up a chemical action with the plaster impression that results in a rough model.

I have here a casting that was cast on a Price stone model. This material is not porous. The result is that the side which comes in contact with the Price stone model shows a pitted surface due to the fact that the air could not be dispersed through it (Fig. 14). But the other surface was the ordinary investment material which is seen to be quite smooth (Fig. 14), illustrating how greatly porosity assists in a process of this kind. From experiments made in casting large pieces, I think the successful casting of a gold or silver plate not far off. With a good model and good investment, and a thorough understanding of the causes of negative pressure, *failures* would be largely *eliminated.* We should always remember that the pressure used should be *relative;* if the investment is changed, the pressure should be. Too great a pressure against a weak, yielding investment produces an expanded inlay, whereas too compact and dense an investment will cause a negative pressure, because there is not force enough behind the molten metal to drive the air out of the mold into the investment.

# Accurate Adaptation to Badly Decayed Roots in Crowning.

By JOHN STEELE, D.D.S., Denver, Col.

A simple and most efficient method of securing an accurately fitting base and pin for crowns is as follows:

Have always ready several platinum posts of small and medium sizes, with disks of gold 32 gauge, 22 k., soldered at about the point to which you might expect the pin to enter the root canal. (Fig. 1.)

Remove all decay and prepare the root in a manner that will give it

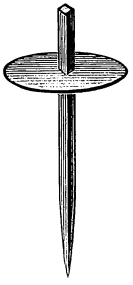


FIG. 1.

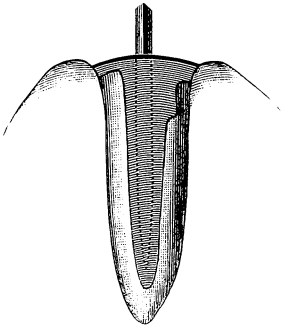


FIG. 2.

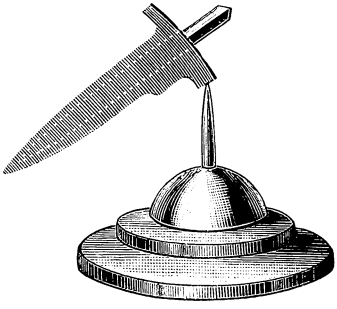


FIG. 3.

greatest resisting strength. Shape the pin so that it enters the root, until the disk just rests on the most prominent part. Trim the disk and bend it until it approximates to the shape of the root.

Flow wax on the under surface of the disk, and if the root is unduly enlarged by decay, let wax extend down on pin. Press the wax to place, chill and remove and trim away any excess. Add more wax if necessary and press to place again. (Fig. 2.)

Remove and insert sprue inside of wax and cast with 20 or 22 k. gold. (Fig. 3.)

You can now depend on having a perfectly fitting base for your crown, most of the speed in taking and accuracy of your impression being due to the fixed disk of gold on the pin.

# Porcelain Fillings without a Furnace.

By D. W. Barker, M.D.S.

*Read before the Second District Dental Society, February,* 1908.

In a paper read before the Kansas State Dental Association last May, Dr. J. P. Root said: "We have had for several years fused porcelain, but its use, for several reasons not necessary now to discuss, has been slowly and surely declining, and probably *to-day not twenty-five per cent. of the fused porcelain inlays are made compared to three years ago.*"

The only point on which I should differ from Dr. Root would be to call it a very rapid decline instead of a slow one.

This, the art which was hailed but a few short years ago as the greatest advance in esthetic dentistry ever made! And yet when the above quoted paragraph was written Dr. Byram had not finished the publication of his papers on the technique of porcelain work. Without considering all the causes for this remarkable decline, I think it is fair to say that in a large measure it is due to difficulties inherent in the process commonly followed. If I can obviate some of those difficulties, check in some degree this rapid decline in use, and restore to favor this undeniably beautiful art, I may, perhaps, be entitled to as much reward as he who causes two blades of grass to grow where but one grew before. My hope to do this is my excuse for this paper.

**Fusing Porcelain without a Furnace.**

I have found that the best way to fuse Jenkin's porcelain is to simply hold the matrix in a very small Bunsen flame, without investment in asbestos, without a melting cup, without a furnace of any sort, without a pyrometer.

It will, perhaps, be a surprise to some to know that Jenkin's porcelain can be fused in an open flame, but until it is tried, it will be still more of a surprise to find how small a flame is necessary.

If an ordinary annealing burner is used the flame should not be more than one-half inch high. Over this little flame the porcelain fuses perfectly in from ten to twenty seconds.

It may be thought that there is danger of fusing the matrix. To this I may say there is a margin of safety between the fusing point of the porcelain and the fusing point of the gold matrix; that is, it is possible to have a flame that will fuse the porcelain perfectly, and yet not fuse the gold matrix. If the flame is large enough to fuse the matrix it is entirely too large.

It may also be thought that there is danger of deforming the matrix. I have not found it so. The matrix is held by the pliers at a point as far as possible from the porcelain; if there is any bending it is close to the pliers and does no harm.

**Details of Technique.**

There are a few simple rules of procedure. A pair of locking pliers with small points are needed. A perfectly steady flame is very essential; any draft must be prevented. The porcelain must be entirely dry. If any alcohol remains it catches fire with a small explosion. If evaported by holding above the flame, care should be taken to hold it far enough to prevent taking fire; and, lastly, the first layer of porcelain should be fused by holding the matrix next the flame; but after that the fusing should be done with the matrix inverted, *i. e.*, the porcelain next the flame. This is important, for if the matrix is next the flame, that which has already been fused must be again brought to the fusing point before the freshly added porcelain begins to fuse. This would have two bad results—the repeated fusing burning the color out, and the high flame required be very likely to fuse the matrix. But by inverting it the new porcelain takes the heat first and fuses before the other reaches the fusing point. The fresh porcelain should not, however, be brought to the fusing point too quickly. If it is, a line of clevage (similar to a fire-check) is formed and the filling breaks at that point. The matrix should be held for a moment about an inch above the flame, and then gradually lowered until the gold begins to glow; at that point the fusing begins. This is all of what might be called the "technique" of this method.

**Advantages.**

In closing, let me point out some of the advantages of this method:

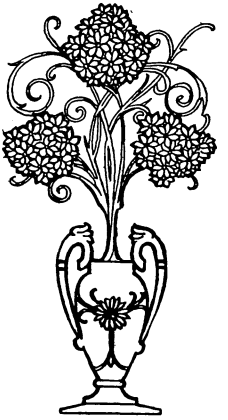
First, the saving of time. Each additional layer of porcelain is fused in from ten to thirty seconds. Cooling it quickly with a drop of alcohol it is instantly ready for the next addition; the process is almost continuous. By the furnace method it takes longer to dry out the investment than it takes to make the filling by this method.

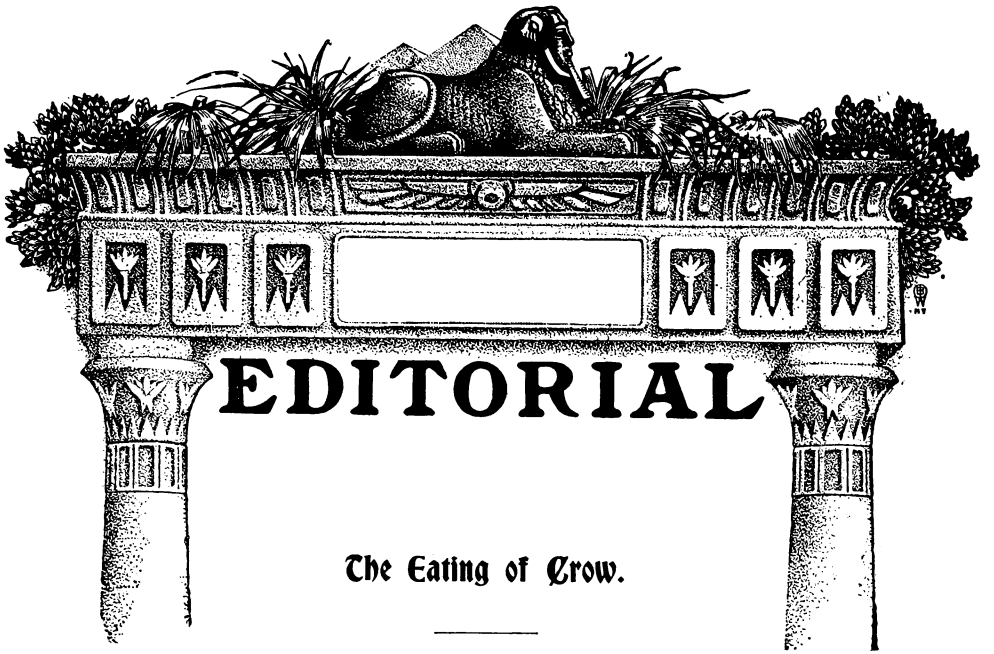
The next advantage is the correct color. I am unable to explain why this method does not burn out the color; I am satisfied with the simple fact that it does not; it comes out right every time without any guess work; it is not necessary to "make it about two shades darker and maybe it will be about right." Of course, it is possible to burn the color out by this method, but it is *never* necessary.

It is entirely practicable to fuse fresh porcelain on one part of a filling—a corner, for instance—without re-fusing the rest of the filling, and thus burning the color out.

If a tooth is of a doubtful color, requiring a blend of two or more shades, a test baking may be made, stripped from the matrix and compared with the tooth and this process repeated until the desired shade is obtained; the filling may then be made with the assurance that it will match the tooth perfectly; this may all be done in ten or fifteen minutes.

Lastly, Dr. Hamlet has suggested it is a great relief to no longer have a gaze into a glowing furnace with eyes that, perhaps, are already tired with an arduous day's labor.





# EDITORIAL

## The Eating of Crow.

From several sources the editor of ITEMS OF INTEREST has been notified that the day will come when he will be compelled to "eat crow." This prophecy introduces a quite interesting subject for debate.

The origin of the expression "eating crow" is somewhat obscure, but the accepted meaning seems to be that the individual indulging in the designated repast must make retraction of some assertion, admit that he had adopted an erroneous position, or in some manner confess a fault.

Upon this interpretation of the phrase, the editor begs publicly to admit not only that in the past he has "eaten crow" more than once, but that in the future he will be quite ready to partake of the dish whenever it may be presented by any one having the power either to persuade or compel the eating thereof.

For what man of us all, is there that can claim to be, or to have been, always in the right? And if it can be proven that one has been, or may be, in the wrong, what better course can be pursued than to frankly admit the error and make amends?

Indeed, the eating of crow, in this view of the diet, far from being

unpalatable or injurious, should prove enjoyable and nourishing. In the final analysis, then, crow should be as vitalizing to the moral manhood as partridge or prairie chicken would be to the physical body.

For which reason, if any person or persons, has or have any crow, which he or they think the editor should devour, the editor begs that the birds be not too long detained in the refrigerator car, because, as in regard to chicken, he prefers that his crow shall be of the spring variety, and broiled while yet of a tender age.

Now, it may further interest some to know just why this dish of crow has been prophesied as due to arrive at the editor's table. The stated reason is, that the editor did on one occasion write an editorial in which he endeavored to tell his readers the truth about the Taggart patents, and to point out how they differed from certain other patents, to which in the past the editor himself made common cause with others of his profession, and registered protest. Also, likewise, and moreover, the editor has admitted to the pages of ITEMS OF INTEREST certain and sundry communications, all favorable to that side of the controversy, which is called "the Taggart side."

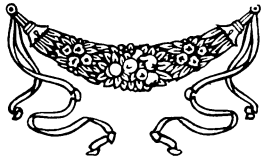
It is not usual for editors to make public list and mention of returned or rejected manuscripts, but, lest some one, through an erroneous idea of the true facts, might be tempted prematurely to forward the promised crow, the editor will for once depart from the custom of his cult and say just a word about those communications written in antagonism of Dr. Taggart, which he has received, but has not published.

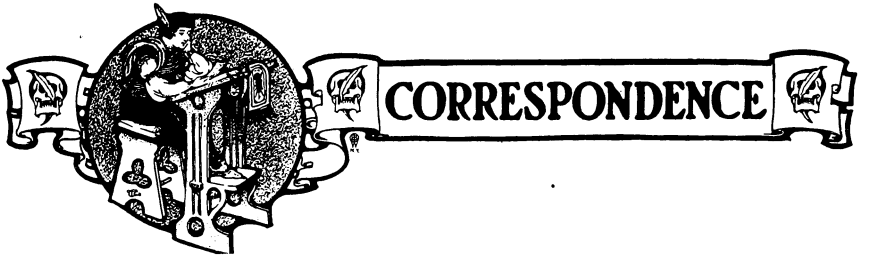
First, however, be it said, that the editor has really hoped, prayed, and even yearned for some logical letter in opposition to Dr. Taggart, which he might print. For surely the publication of some such letters would absolve him from the accusation of partisanship. But up to date only a few letters have arrived which aimed to disclose the opposite side of the shield. In each case the editor scanned the written pages carefully, and was disappointed to find that the writer was writing from false premises; that he was basing his argument upon misinformation, lack of knowledge, or misconception. In each instance the writer was courteously informed of the weakness of his assumed position. In no case was publication refused, but in all cases the writers withdrew their letters with thanks to the editor.

Thus the editor is still waiting. Waiting for some one to defend the dental profession and to prove that it is ethical to pirate the inventions of a professional brother, and to make use and money out of the work of another man's brains on the specious argument that said other man was unethical in taking a patent. Or, from another angle, the editor would welcome communications that would prove that Taggart did not invent what he says he invented; or that the dentists are not in his debt; or that they are properly paying the debt, if it be admitted that it exists. In short, the editor begs to announce that now, as ever, ITEMS OF INTEREST is an open forum for decorous impersonal discussion of all that will tend toward the uplift or the progress of dentistry or dentists.

Meanwhile, those who are crow-hunting may be reminded that this particular member of the winged tribe is "a wise old bird," and that he does not often mistake a broomstick and a flannel shirt for a real man. Indeed, those who have studied the crow declare that he can count up to five, which means that if five men go behind a blind, intent upon the killing of Mr. Crow, and if only four of these men return, the aforementioned Mr. C. cocks one eye at his mate and laughs, "Caw! Caw!" but he flies not within gunshot of the blind, which concealeth the fifth man and his little gun. For he has counted those that departed, and he knows the total of two plus two.

For which reason is it that your crow is more often seen alive than dead, and, of course, even crow must be killed before being eaten. Therefore, gentlemen, produce the crow and let us fare forth to the feast. The editor will partake but, oddly enough, he fancies that he is quite as apt to be host as guest, at this banquet of crow.






## Dr. Taggart Again.

Editor ITEMS OF INTEREST.

Dear Sir: The *Dental Review* for May contains a defense by Dr. Thurston of those who are casting inlays without any pecuniary acknowledgment of their obligations to Dr. Taggart, and the undersigned has received one letter setting forth similar views. (A number of others have been received thanking him for the two communications about "Dr. Taggart and the Dental Profession.") The argument may be briefly stated without exact quotations as follows:

"It is recognized that professional men have a different standpoint from business men, and that it is our duty to freely give to our fellow practitioners any knowledge or discovery found in the course of our investigations, and there are many discoveries of great value for which it is impossible to recompense the men who have given up time and money for the good of their profession, their investigations in many cases extending over their life periods, and further, 'If users of casting machines other than Dr. Taggart's are thieving the privilege, then every dentist is on the same plane and under monetary obligation, the value of which it would be well nigh impossible to compute, to a great many of our greatest researchers. Who is there among us who can estimate the value to him of the discoveries made by our Dr. Black? Who is there who has not derived benefits from such men as our present orthodontists, and Dr. Atkinson, and has any word from any of these venerated gentlemen been forthcoming in reference to commercial obligations on the part of the profession?' "

The plea for justice to Dr. Taggart does not require that we forget or disparage the services or inventions and discoveries that other men have freely given to their profession. Personally, I believe that the services of Dr. Black to the dental profession have been far greater from every point of view than those of Dr. Taggart, probably greater than those of any other man of this generation. The argument ignores an important distinction and one or two important limitations: the distinc-

tion between receiving as a free gift and demanding as a right, or taking because the giver can not help himself. The duty of giving is necessarily limited by what a man has to give, and by what he can spare without injustice to other demands upon him, and as a matter of fact by his willingness to give, for most men concede the right of every man, professional or otherwise, to judge for himself as to what he has to give and what he can afford to give.

The duty of giving to the profession is very closely similar to the duty of giving our professional services in charity to those who can not pay for them. Very few men would deny that obligation, but none of us would allow any one to come into our offices and *demand* gratuitous services, even if we knew he could not afford to pay for them. That is just about exactly what the dental profession are now doing to Dr. Taggart, and they can afford to pay him, too. It is the duty of a man who has anything valuable and interesting to say, to read papers before dental societies, but the societies do not *demand* that he shall travel a thousand miles to do so. They *invite* him, and if the distance is great usually pay his expenses, and, generally speaking, all professional men are allowed to be their own judges of the nature and of the extent of the sacrifices that professional duty requires them to give for the benefit of their brethren.

For many years Dr. Taggart belonged in the list of the free givers to his profession, but in this instance he found himself facing an opportunity and a process or method that required for its development and perfecting an investment of time, and money, and credit, and the scattering to a great extent of his practice, that he could not possibly afford without compensation. He believed the method would be worth enough to the profession to justify the investment, and he believed that he could require from the profession a suitable compensation for it. If the method had proved worthless or impracticable, or if very few had been willing to adopt it, he would, of course, have lost what he had put into it as others do who make bad investments; but it did not prove worthless, and it is pretty safe to say that twenty thousand dentists are now using the casting method. It is equally safe to say that none of them would quit if he were obliged to pay one hundred dollars apiece for the privilege, and very few would charge their patients any more either.

The only excuse for the restriction in respect to holding patents, contained in the medical code of ethics, is to prevent any restriction of the use of any medicine or instrument or process for the benefit of patients wherever needed, but if the principal use of this article of the code were to enable the masses of the profession to rob their benefactors, the sooner it were eliminated from the code the better. The dental code

of ethics has never had any similar section, and there is nothing whatever in it to prevent any member of the dental profession from holding and enforcing any kind of a patent.

One hundred dollars apiece for twenty thousand dentists amounts to two millions of dollars, and this is a very moderate estimate of the value the dental profession themselves will put upon this process if they are ever forced to choose between paying for it or doing without it. Some of us can remember the time when there was no dentist anywhere too poor to pay fifty dollars or more every year to the Goodyear Dental Vulcanite Co., and the uses of vulcanite were not appreciably restricted nor the prices to the people appreciably increased by the millions of dollars which the Vulcanite Co. collected from the dentists at a time when their aggregate incomes were less than one-third of what they are at present.

I have written these communications because I very earnestly desire two or three things. First, that justice be done to Dr. Taggart, but even more than that I desire that our professional ideals and standards should be maintained at their highest level, and that our unwillingness to pay an office license should be respected. I have seen no way to accomplish all these ends except by the purchase of Dr. Taggart's machines, or individual settlements with him in sufficient numbers to fully accomplish these ends.

Dr. Thurston in the article in the *Dental Review* referred to says:

"Would the profession be justified in acknowledging the Taggart machine as being the only one and smothering the other conveniences? Does Dr. Taggart wish to cut off his generosity to the profession at the completion of his machine and say 'I wish to smother all other methods and progress along this particular line?'"

This is sheer nonsense. Pay to Dr. Taggart a hundred dollars because the process you have received from him is worth that much to you, and take his machine or leave it as you may prefer; or, having taken it, lay it aside and get a better one whenever you find an opportunity, exactly as you would do with an electric furnace or a vulcanizer.

It seems to me that either the winning or the losing of Dr. Taggart's suit will be very unfortunate. If he loses, the result will be very disastrous to him, and likely to lead to the disgrace of our profession, for a business man could plainly say to us, "If your boasted high ideals and standards of ethics call for such treatment as you are giving to Dr. Taggart, then our business standards are better than yours, for we do recognize the duty of men to pay for what they get unless they receive it as a gift." If Dr. Taggart wins his suit he will have the power to collect from us the hated office licenses, and to an amount in the aggregate six or eight times the price of his machines, and if he did not choose

to do so it would still be a misfortune to the profession to have a decision on record that confers such a power.

Gentlemen of the profession, this case is no exception to the rule that it is wiser, often cheaper, and always in every way more satisfactory to do what is right and discharge obligations voluntarily than to wait for the result of a lawsuit to compel us; or to permit us to repudiate just debts, as the suit may happen to result one way or the other. What I have written is not to be taken as necessarily calling in question anybody's motives or intentions. What I have desired to do is to strip the question of side issues and subterfuges and prevent, if possible, the gross misapplication of our highest ideals of service and duty to the profession. It is a personal question and it is up to you, and you, and you, the whole twenty thousand of you, who are casting inlays, and I beg of you, each one, to take it up and settle it in your own minds, and discharge to your own satisfaction your obligations to Dr. Taggart.

There appears to be a very general demand that Dr. Taggart withdraw his suit. He faced the alternative of defrauding his creditors by becoming a bankrupt, or finding out by a lawsuit whether he has any legal rights in the premises. No honest man could hesitate which to do. The profession forced this alternative and it is up to the profession to remove it.

There is, perhaps, enough probability that some who do not know me may suppose that I have some financial interest in the success of Dr. Taggart's suit, or the sale of his machines, to justify saying that I have none, except that I bought one of his machines as soon as I could get it, and have paid full price for it. EDMUND NOYES, D.D.S.

Chicago, Ill., June 2, 1909.

## Decision of Supreme Court, and Its Relation to the Taggart Patents.

June 8, 1909.

Editor ITEMS OF INTEREST:

On June 1, 1909, the Supreme Court of the United States decided one of the most important patent cases that has been brought before it in years, and one that is of vital interest to the dental profession, especially at this time, inasmuch as it covers the principle involved in the Taggart vs. Boynton suit now before the Court in Washington, D. C., as to the validity of the Taggart process patents.

The case referred to is that of "The Expanded Metal Co. vs. Eugene Bradford," upon the validity of a process for manufacturing expanded metal for the various mechanical uses to which it is applicable.

The dental profession for years have resisted the issuance of process patents pertaining to methods and procedure in the healing arts, both

medical and dental, and with others interested, Dr. Ottolengui and myself, as a committee of the National Dental Association and various State societies, undertook for some years to have a law passed by Congress excepting medical and dental processes and methods from the protection of the United States patent laws. Pending a decision of the Supreme Court upon the Expanded Metal case, which involved the whole question of process patents and their validity, nothing was done further in the hope that the Supreme Court would decide against all processes not involving "chemical or other elemental action," as has been indicated might be done in the decisions of that court for the past twenty-five years, in the language used in *Corning vs. Burdon,* 15 *How.* 252, and *Risdon Locomotive Works vs. Medart,* 158 *U. S.* 68, and upon *Westinghouse vs. Boyden Company,* 170 *U. S.* 537. I have found in observing the action of this Court in the past, that when by a series of decisions it indicates certain action should a case involving the principles in question come before it, it would follow those indications very closely, as illustrated in the Design Patent decision, *Rowe vs. Blodgett & Clapp Co.,* 98 *O. G.* 1274, which changed the whole method of the patent office in the issuance of design patents.

For some reason, in the Expanded Metal case, this proceeding was reversed, and we find the Court deciding directly opposite, upon the very question and point, which the Court itself brought out, though not involved in the question before them, upon which they were to decide; in fact all these indications were gratuitous expressions, and, therefore, as pertinent almost, as if decided at the time, as indicating how they might decide if the point were up on its merits. This is plainly shown in the following language used in the last decision previous to the Expanded Metal case, *Westinghouse vs. Boyden Company,* 170 *U. S.* 537: "These cases (158 *U. S.* 68, and 103 *U. S.* 461) assume, although they do not expressly decide, that a process to be patentable must involve a chemical or other elemental action, and it may be still regarded as an open question whether the patentability of processes extends beyond this class of inventions."

In this it will be seen that the whole question as to the patentability of processes other than alluded to, was a matter of doubt, but that doubt has now been dispelled, and there can be no question in the future, but that under the Patent Laws of the United States, process patents of all descriptions, except those involving the function of a machine, are patentable, and, being patentable, a process patent issued by the United States Patent Office, will be held valid by the courts, and infringments will be liable to injunctions and accounting, as well as damages for the same.

**Effect of the Decision on the Taggart Patents.**

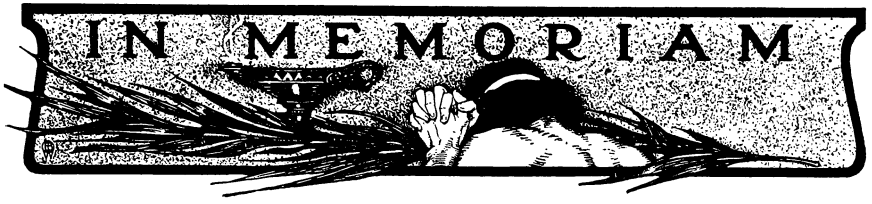
No matter how much our profession may feel disposed to resent the principle, there is now but one of two ways open for it to act; first, to "look pleasant and pay up"; and, second, to again go before Congress with a bill to prohibit the patent office from issuing process patents in the healing arts, so wording the same as not to involve so-called class legislation, and I feel certain that if properly pushed Congress would enact such a law. That is a matter for the dental profession to decide, but in the meantime we are confronted with the process patent of Dr. Taggart, issued in legal form by the United States Patent Office, which will, without doubt, be taken to the Supreme Court for final decision, in case of defeat in the Court before which it is now pending, by either party at Bar. Therefore, it is interesting, in view of that Court's last decision, to know what it says, which is as follows: "We, therefore, reach the conclusion that an invention or discovery of a process or method *involving mechanical operations,* and producing *a new and useful result,* may be within the protection of the Federal statute, and entitle the inventor to a patent for his discovery."

With that decision in such plain words that none can be so stupid as to misunderstand, with the knowledge that Taggart's patents on his process *"involve mechanical operations,"* that the universal acceptance by our profession that this process procured a *"useful result,"* and the fact that throughout the whole country the process and method was most generally and enthusiastically proclaimed wherever shown in dental society meetings to be *"new,"* it would appear to the average mind that the profession might better turn from its abortive attempt to fight what is plainly a "right," which Dr. Taggart has to a financial return for his inventive efforts to a legitimate attempt to have Congress pass a law excepting "processes which involve methods and procedure relating to the public health," from the benefits of the patent system.

It may be said that there is a question as to whether Dr. Taggart is the inventor of the process which bears his name, and I believe that fact was brought forth in a late letter published and circulated by the gentlemen who are acting as a committee to fight the Taggart patents, mentioning some methods and some names of men who are supposed to have antedated Dr. Taggart, but, granting all that they claim, with the knowledge which the whole dental profession has as to the "state of the art," when Dr. Taggart brought the method or process to public knowledge, and, granting for the sake of argument, that this committee can prove by its witnesses all that they claim in their circular letter, is it reasonable to suppose that the Court will not hold that Dr. Taggart's method is *"an improvement upon all or any heretofore known method or process"?*

No one to my knowledge has ever questioned that Dr. Taggart did invent his process or method. Then in all faith has he not all the elements that go to make a valid patent, viz., "invention" of a "method or process" that is "new and useful" and "an improvement" upon any known method previous to his public exhibition of the same; and "utility," by the fact that the method has practically revolutionized the prosthetic work of our profession in the short period of less than three years from its introduction by the claimed inventor? Can any one for a moment doubt that the Court will recognize all these facts, which are as plain as day, as it has repeatedly done in the past in similar cases where *"previous invention"* has been claimed? I do not think these questions need further comment, and while I am opposed to all process patents which involves our professional work in the healing art, I, for one, am not inclined to "bay the moon," but after a careful investigation of the literature pertaining to Dr. Taggart and his inventions, my candid opinion is that a little common sense, used with discretion under present circumstances, would save lots of trouble, some dollars and a few reputations, as well as bring important concessions to our whole profession. The Supreme Court has the last say, and as it has already spoken upon the principle involved, it would appear to a casual observer that it is about time to *"get into the band wagon."*

EMORY A. BRYANT, D.D.S., LL.B., M.P.L.




## Dr. C. Newlan Peirce.

Dr. C. Newlan Peirce died at his home in Philadelphia in the eightieth year of his age on May 16, 1909. Dr. Peirce had been ill for three months, and his death, therefore, was not unexpected. Dr. Peirce was born March 5, 1829, in Biberry, Pa. He was the son of Sirus and Ruth Peirce. He was reared on his father's farm, and later taught school for some time.

He was a student of dentistry under Dr. Frank N. Dixon, one of the prominent dentists of Philadelphia of that period. He entered the Philadelphia College of Dental Surgery in 1852, graduating in 1854. He practiced his profession in Philadelphia, and in 1858 became the professor of physiology and operative dentistry in the Pennsylvania College of Dental Surgery. In 1862 he was made the dean, which position he held until 1865, when he was succeeded by Dr. James Truman, having resigned in consequence of his professional duties. In 1878, however, he assisted in the reorganization of the faculty of this school, and again became the dean of the faculty. He continued his connection with the school as professor and dean until 1898; then he again resigned from the faculty, shortly afterward retiring from practice. He was one of the charter members of the Pennsylvania State Dental Society, and was president in 1878 and 1879. He was president of the American Dental Association in 1880, and was elected president of the Pennsylvania Board of Dental Examiners in 1876. He was the first president of the National Association of Dental Faculties, and was acting honorary member in many local dental societies. Dr. Peirce contributed many valuable papers to the literature of our profession, those dealing with the relation between uric acid and pyorrhea alveolaris causing much discussion.

Dr. Peirce was a birthright member of the Society of Friends. He was an old-time Abolitionist, and in politics was an independent Republican. He was vitally interested in the question of giving men and women the same opportunities for education and in everyday affairs. For many years he was secretary of the Woman's Medical College. He was also for a long period president of the Ethical Society of Philadelphia.

He was a member of the Contemporary Club and of the Academy of Natural Sciences, and was interested in biological and kindred sciences.

Dr. Peirce is survived by his widow, Mrs. Charlotte L. Peirce; his daughter, Mrs. F. H. Easby, and four grandchildren. Two of the latter were children of Dr. Peirce's son, the late Arthur H. Peirce.

## Dr. M. B. Shuman.

WHEREAS, An allwise Providence has seen fit to remove from our midst in the morning of life, and in the promising period of his professional career, our esteemed fellow member, Dr. M. B. Shuman; and

WHEREAS, His professional zeal and devotion to our organization was shown by his presence at the opening hour of our late meeting notwithstanding that he was already ill with the fatal disease that necessitated his withdrawal before adjournment; therefore, be it

*Resolved,* That in the death of Dr. M. B. Shuman, the Lebanon Valley Dental Association loses a beloved member, whose brightness and geniality commended him to all, and whose absence will cast a shadow upon our future gatherings; and

*Resolved,* That these resolutions be spread upon the minutes of our society, and that a copy be sent to the bereaved parents and family of our departed brother and friend, also to the dental journals for publication.

C. R. SCHOLL, D.D.S.,
C. V. KRATZER, D.D.S.

GEO. S. SCHLEGEL, D.D.S.,
Chairman of Committee.

## Dr. Wm. P. Loppentheim.

Resolutions adopted by the Arizona Board of Dental Examiners upon the death of Dr. Wm. P. Loppentheim.

WHEREAS, The Arizona Board of Dental Examiners learns with deepest sorrow and regret of the death of one of its most active members, Dr. Wm. P. Loppentheim; and

WHEREAS, Dr. Loppentheim's admirable personal qualities, high professional attainments, and exalted ideals commanded the profoundest respect of all; therefore, be it

*Resolved,* That in the death of Dr. Wm. P. Loppentheim the public, the dental profession and the dental board has suffered an irreparable loss. Although for years in failing health, he labored on to the last with untiring energy and undaunted zeal, conscientiously serving his patients and his profession and setting an example that others may well emulate.

*Resolved,* That the members of this board extend to the bereaved family in its affliction their sincere sympathy.

*Resolved,* That these resolutions be sent to the widow of our departed member and be spread upon the minutes of this board, and that copies be forwarded to the dental journals for publication.

J. HARVEY BLAIN, Secretary.

# SOCIETY ANNOUNCEMENTS

## National Society Meetings.

National Association of Dental Faculties Old Point Comfort, Va., August 2, 3, 4, 1909.

National Association Dental Examiners, Old Point Comfort, Va., August 2, 3, 4, 1909.

American Society of Orthodontists, Cleveland, Ohio, October 4, 5, 6, 1909.

## State Society Meetings.

Colorado State Dental Association, Colorado Springs, Col., July 12, 13, 14, 1909.

Ohio State Dental Society, Columbus, O., December 7, 8, 9, 1909.

Oregon State Dental Association, Portland, Ore., July 12, 13, 14, 1909.

Utah State Dental Society, Logan, Utah, latter part of June or first part of July.

Virginia State Dental Association, Old Point Comfort, Va., July 21, 22, 23, 1909.

Washington State Dental Society, Seattle, Wash., July 15, 16, 17, 1909.

West Virginia State Dental Society, Wheeling, W. Va., October 13, 14, 15, 1909.

Wisconsin State Dental Society, Milwaukee, Wis., July 13, 14, 15, 1909.

## American Society of Orthodontists.

The ninth annual meeting of the American Society of Orthodontists will be held in Cleveland, Ohio, on Monday, Tuesday and Wednesday, October 4, 5 and 6, 1909.

FREDERICK C. KEMPLE, Secretary.

43 West 48th Street, New York City.

## Virginia State Board of Dental Examiners.

The regular annual meeting of the Virginia State Board of Dental Examiners will be held in Richmond, Va., the second Tuesday in June, 1909.

For further information address

DR. J. P. STIFF, Secretary.

Fredericksburg, Va.

## Alumni Association, College of Dentistry, University of California.

The Alumni Association, College of Dentistry, University of California, and the California State Dental Association will hold a joint session on July 6, 7 and 8, at the College of Dentistry Building, First and Parnassus Avenues, San Francisco.

Arrangements are being made which promise to make the session mark an epoch in dental work on the coast. Dr. John Q. Byran has been secured and attendance at his clinic will be equal to a post-graduate course in porcelain. Negotiations are being continued for one other Eastern clinician with promise of success.

Save these three days for a most profitable meeting—the knowledge gained will amply repay you.

## W. D. Miller Dental Club.

At the annual general meeting of the W. D. Miller Dental Club, of Berlin, the following officers were elected for the ensuing year: President, Dr. C. H. Abbot; vice-president, Dr. H. Boedecker; honorary secretary-treasurer, E. Lawley-York.